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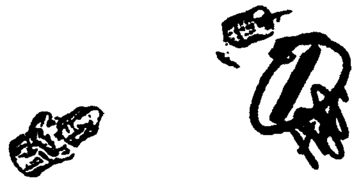

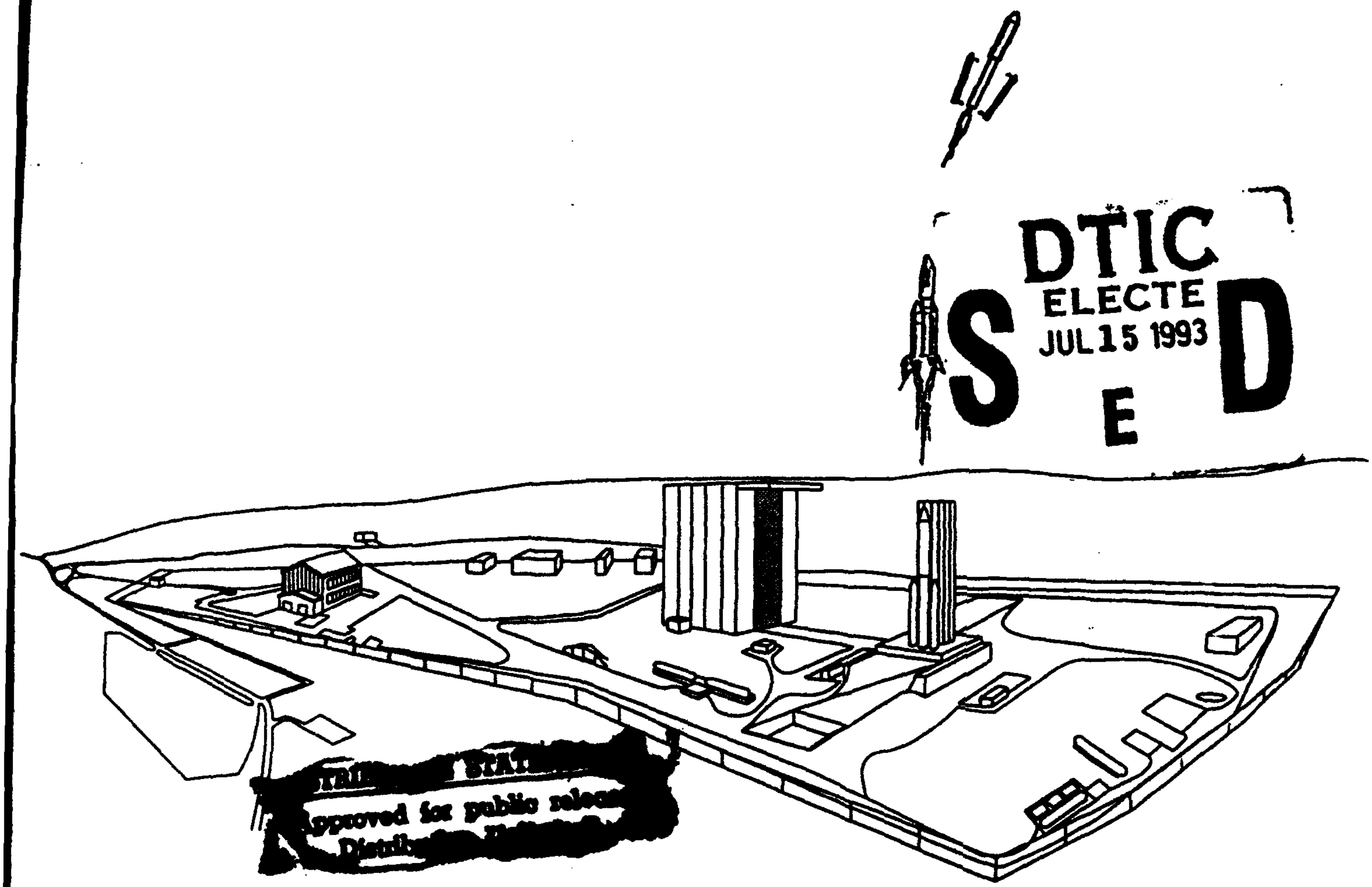

ENVIRONMENTAL IMPACT ANALYSIS PROCESS

VOLUME I

PRELIMINARY
DRAFT ENVIRONMENTAL IMPACT STATEMENT
CONSTRUCTION AND OPERATION OF
SPACE LAUNCH COMPLEX 7

VANDENBERG AIR FORCE BASE, CALIF.
6 APRIL 1989

[redacted] DEPARTMENT OF THE AIR FORCE

93-16049

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COVER SHEET

(a) Responsible Agency: U.S. Air Force

(b) Proposed Action: Construction and operation of Space Launch Complex 7 (SLC-7) on South Vandenberg Air Force Base (VAFB), California. The facility would provide for processing and launch of the Titan IV/Centaur, an unmanned space vehicle: (1) to support requirements for timely and reliable launch of critical Department of Defense (DOD) satellites from a location where highly inclined and polar orbits can be safely achieved, (2) to provide capability to launch payloads in the 10,000 pound class to high energy, inclined orbits, and (3) to maintain assured access to space by providing backup launch capability for the Titan IV/NUS (No Upper Stage).

(c) Responsible Individual: Mr. John Edwards
HQ SD/DEV
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Phone: (213) 643-0934

(d) Designation: Draft Environmental Impact Statement (DEIS)

(e) Abstract: This DEIS addresses the construction and operation of the proposed SLC-7 project at Cypress Ridge on South VAFB, California, to provide for processing and launch of the Titan IV/Centaur, an unmanned space launch vehicle, capable of launching payloads in the 10,000-pound class into high energy, near polar orbits.

Alternatives to the proposed action include other launch vehicles, specifically the Space Shuttle, Titan IV/NUS, and Titan 34D, and alternate launch locations in Florida, the South Pacific, and on VAFB.

Primary impacts to the natural environment of South VAFB involve soil and vegetation loss during construction, and effects of sonic boom on Channel Islands wildlife during launch events. Primary impacts to the human environment of north Santa Barbara County relate to the potential for a maximum of 550 employment opportunities during project construction and 400 during operations. The primary regional effects of temporary and permanent increases in population would be increases in economic activity and in demands on public services and facilities. Other effects would include the visual effect of the near coastal location of the space launch complex and the potential closure of Jalama Beach County Park during launch events. Potential impacts to health and safety also would occur, related to the fuels utilized, plus the generation of hazardous waste.

Impacts to the environment from implementation of the proposed project at the Vina Terrace or Boathouse Flats alternative sites would be similar to those for the proposed action. For most environmental considerations, impacts from implementation at the SLC-6 site would be substantially less.

(f) Released to the public _________. A PUBLIC HEARING ON THE DEIS WILL BE HELD ON _________, BEGINNING AT _________ IN THE _________. All written comments to this DEIS must be received by _________.

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SUMMARY

This Draft Environmental Impact Statement (EIS) has been prepared as part of the United States Air Force (USAF) Environmental Impact Analysis Process (EIAP) for evaluation of proposed major projects, in compliance with the National Environmental Policy Act (NEPA) and the regulations of the President's Council on Environmental Quality (CEQ) for NEPA compliance. The Draft EIS presents an analysis of the purpose and need for the proposed action and its alternatives. Chapter 1.0, Introduction, is a procedural and regulatory review of the EIS process as it relates to the proposed action. Chapter 2.0, The Proposed Action and Alternatives, describes the project in detail, addresses alternatives, and summarizes project impacts and mitigation measures. Chapter 3.0, Affected Environment, provides a description of the potentially affected physical and human environments. Chapter 4.0, Environmental Consequences and Mitigation Measures, describes the potential impacts of implementing the proposed action and alternatives and presents mitigation measures to avoid or reduce those impacts.

PROPOSED ACTION AND ALTERNATIVES

The proposed action is the construction and operation of a Titan IV/Centaur space launch complex in support of the Department of Defense (DOD) space program. The project is designed for a minimum of 25 years, with construction planned to begin in 1990, followed by operations in 1994. Known as Space Launch Complex 7 (SLC-7), the project would be located on South Vandenberg Air Force Base (VAFB), California. The Titan IV/Centaur is an unmanned, expendable launch vehicle capable of launching critical DOD payloads in the 10,000-pound class to high energy orbits. The proposed facility at VAFB would support requirements for timely launches of these payloads from a location where highly inclined and polar orbits can be safely achieved. This action would maintain assured access to space by providing backup launch capability for the Titan IV/Centaur and Titan IV/NUS vehicles.

The SLC-7 facility would be a fenced area of about 50 acres, within which the major preparation and launch activities would occur. Some related activities, including launch control and core vehicle and satellite processing, would occur at existing facilities on VAFB that currently operate in support of Scout, Titan II, and other Titan IV programs. The primary elements of the SLC-7 project, to be constructed and operated onsite, would be the vehicle launch support structure/flame duct, launch mount, umbilical tower, and mobile service tower. There also would be an operations support building, access roads and parking, fuel storage, security systems, and

fire protection. Offsite facilities include water storage tank(s), sewage treatment plant, evaporation/percolation ponds, electrical substation, and communications and utility corridors.

It is expected that project construction would occur over a four-year period, with personnel generally ranging from about 100 to 425, increasing to about 550 during peak construction. During project operations, employment would average 300 persons, with pre-launch peaks to 400.

Alternatives to the proposed action were evaluated. Other launch vehicles, including the Space Shuttle, were considered but determined not to be viable, based on lack of availability or inability to achieve required orbits. Alternate locations were evaluated. Cape Canaveral Air Force Station (AFS) was rejected because of inability to safely attain polar orbits. Other sites remote to VAFB were eliminated from further consideration due to location and/or the absence of necessary infrastructure.

The no action alternative was also evaluated and determined not to be a viable solution to the Department of Defense requirements. Use of existing facilities neither supports the requirement for timely launch of critical DOD satellites nor provides the backup capability (i.e., for launches from Cape Canaveral AFS and SLC-4 East) which experience demonstrates is necessary for assured access to space.

From the range of alternatives considered, it was determined that the development of Titan IV/Centaur launch facilities at South VAFB would present the most reasonable course of action, according to mission requirements, technical needs and cost, engineering, and design considerations. Based on siting factors and mission requirements, one proposed site, Cypress Ridge, and three alternative sites, SLC-6, Boathouse Flats, and Vina Terrace, were identified for further consideration. Of the four sites, three are undeveloped, and one is an established space launch complex. The proposed Cypress Ridge and alternative Boathouse Flats and Vina Terrace sites are undeveloped and located on South VAFB near the southern boundary of the base. The alternative SLC-6 site lies to the north of the other three, but also is located on South VAFB. The SLC-6 site was modified to support the Space Shuttle, and it currently is in caretaker status.

ENVIRONMENTAL SETTING

The proposed site and the three alternatives are located within the same general area of South VAFB. Therefore, the characteristics of the existing environmental setting are generally the same for the four sites. The primary differences relate to topography and previous development. The

Boathouse Flats alternative is located on a flat plain atop a coastal bluff, and the Vina Terrace alternative is situated along a ridge line at an elevation of about 800 feet. The proposed Cypress Ridge site is intermediate between the two. The SLC-6 alternative is located on an elevated marine terrace about one mile north of the Cypress Ridge site. Unlike the other three sites, SLC-6 has been extensively developed with structures and facilities to support launches of the Space Shuttle.

The general project area is within one mile of the Pacific Ocean at the western-most termination of the Santa Ynez Mountains and is underlain by bedrock of the Monterey Formation. Several potentially active faults are known to exist within 60 miles. Surface and ground water resources in the vicinity are limited, consisting primarily of several perennial and ephemeral streams that drain directly into the ocean. Potable water is provided from the nearby Lompoc Terrace aquifer, as no appreciable ground water supply has been found in the vicinity of the four sites. The area is generally arid, with average annual precipitation of about 16 inches per year, primarily between November and April. Stream flow depends primarily on rainfall, with relatively high yields during periods of precipitation due to the relatively steep local topography.

The climate is Mediterranean. During summers, the area is characterized by persistent night and morning low cloudiness and fog and also is subject to Santa Ana wind conditions, when strong, gusty, warm and dry winds blow westward from the inland desert. The air quality is generally good, with the exception of infrequent occasions when ozone exceeds ambient air quality standards. These occur primarily when meteorological conditions are such that pollutants generated in the Los Angeles basin are blown northwest to the project site.

The proposed project area is located within a boundary region between coastal southern and central California provinces. At the southern end of the Coast Ranges and western end of the Transverse Ranges, the area contains a number of vegetation and animal species that have reached their northern, southern, or western limits and, for this reason, is within an area of ecological and biogeographical interest. Much of the local vegetation has been modified or disturbed by humans over the past century. In general, the proposed project area is vegetated with central coastal scrub, ruderal vegetation, riparian scrub, and small wetlands. In some areas, individuals of the Federal Category 2 candidate species curly-leaved monardella (*Monardella undulata* var. *frutescens*) occur. Other special interest plants in the project area include large-leaved wallflower, western dichondra, and fiddleneck.

Because of its coastal orientation, the project impact area contains animals of both terrestrial and marine species. In general, the wildlife community tends to be composed of common, wide-

ranging reptile, amphibian, mammal, and bird species that tend to frequent a variety of habitat types found throughout the region. Active sign of badger (*Taxides taxus*), a regionally rare mammal, was observed on the site during 1988 field inventories. Mountain lion (*Felis concolor*), a protected species in the state of California, may be expected to occur in the vicinity. Six species of birds that are federal- or state-listed or federal candidate species are known or expected to occur in the vicinity: California brown pelican, ferruginous hawk, American peregrine falcon, California least tern, Western snowy plover, and long-billed curlew. The unarmored three-spine stickleback, a federal- and state-listed endangered species, has been introduced into Honda Creek, about two miles north of SLC-6 and about three miles north of the Cypress Ridge, Boathouse Flats, and Vina Terrace sites.

The northern (Santa Barbara) Channel Islands are included in the study region because they occur beneath the space vehicle overflight area and could experience launch-related impacts, primarily sonic booms. The northern Channel Islands contain a poorly developed animal population composed of species that are common and widespread along the mainland. The island fox, a state-listed threatened species, occurs on the largest islands. Within the marine region of the project area are several haul-out areas for harbor seals, California sea lions, and occasional elephant and Northern fur seals. Harbor seals are the only known pinniped species to use these hauling grounds as rookeries in the spring.

The visual environment in the vicinity of South VAFB is varied, characterized by rolling hills, valleys utilized for agriculture and grazing, and urbanization of the nearby Lompoc Valley. Topography is dominated by the east-west trending Santa Ynez Mountains, which narrow near the coast and terminate in the project area. The Cypress Ridge site is at the western extreme of these mountains and slopes toward the south onto an elevated marine terrace. It is within an area of considerable archaeological interest, with previously recorded archaeological sites within the project area and other sites known or suspected as a result of the inventory completed for the Draft EIS. One of these, first recorded in 1974, occupies a large portion of the Cypress Ridge site and, with three others, is part of the Oil Well Canyon site cluster, determined eligible for inclusion in the National Register of Historic Places.

The primary socioeconomic area of influence is the North County region of Santa Barbara County, north of the Santa Ynez Mountains. Generally, North County employment is concentrated in agriculture, manufacturing, and government. VAFB is a major economic force, estimated to provide about two-thirds of local job opportunities. Santa Barbara County had an estimated 1988 population of 345,000, with 32,300 in Lompoc, 53,000 in Santa Maria, and about 8,000 at

VAFB. The North County is a growing area, in response to employment opportunities related to VAFB, the oil and gas industry, and as a bedroom community to the city of Santa Barbara. Both temporary and permanent housing are available, as are public services and utilities.

The proposed project area, like the surrounding region, is primarily undeveloped and rural, and sound levels measured for most of the region are low, with average background CNEL levels of about 40 to 45 dBA. Higher levels appear in industrial areas and along transportation corridors. Land use both in the county and in the vicinity of VAFB consists primarily of agriculture/grazing and other undeveloped uses, plus a few urban areas, primarily the cities of Lompoc and Santa Maria. Land use on VAFB is primarily (97 percent) open space. Public recreation in the vicinity of the proposed project area is limited and consists primarily of Jalama Beach County Park, adjacent to the south of VAFB, and Ocean Beach County Park, at the mouth of the Santa Ynez River.

The transportation system affected by the proposed project primarily would be the highways in the vicinity of Lompoc and VAFB and surface streets within the city of Lompoc. The main transportation routes in the area connect with Highway 101, the main north-south transportation corridor in the region. Access to VAFB and the project area is provided by four gates and paved roadways through the base. In general, there is little traffic on South VAFB roads.

IMPACTS AND MITIGATION MEASURES

There are potential impacts to the natural and human environments that could result from implementation of the proposed action. Many of these would be minor, and most would be minimized through project design and/or application of existing state, federal, and USAF rules and regulations, and/or mitigation measures. Potential impacts to the natural environment are related to geology and soils, vegetation, wildlife, water resources, air quality, noise, and cultural and visual resources. Potential impacts to the human environment are related to waste management, health and safety, socioeconomics, transportation, land use, and recreation.

At the proposed Cypress Ridge and alternative Boathouse Flats and Vina Terrace sites, geology and soils impacts would occur primarily during the four-year project construction period, especially during grading activities, with soil loss on the order of 4,000 tons per year anticipated. This would be mitigated to the extent possible by erosion control measures during construction. Implementation of the proposed action at SLC-6 would minimize soil loss, since no grading or

excavation activities are anticipated. Other potential impacts to all of the sites, such as from earthquakes and slope failure, would be minimized through project design.

Vegetation would be lost as a result of the proposed action. The amount lost would depend on which site is chosen, with a potential loss of 120 to 150 acres at the three undeveloped sites. Of the undeveloped sites, about 50 acres would be permanently disturbed, covered by impervious surfaces. No additional disturbance is anticipated at SLC-6, as the launch complex is already developed, since no grading or excavation is anticipated. Development at the proposed Cypress Ridge site would result in the loss of about 800 to 1,000 mature individuals of the Federal Category 2 candidate species curly-leaved monardella (*Monardella undulata* var. *frutescens*). This impact would not be significant on a regional level due to the size of regional populations.

Wildlife populations would decrease or be displaced due to loss of habitat, resulting primarily from grading activities at the proposed Cypress Ridge and alternative Boathouse Flats and Vina Terrace sites. Implementation of the project at one of these sites would represent a small portion of available open space on South VAFB. These effects would not be significant. Implementation of the project at SLC-6 would result in a lower level of impact since there would be minimal loss of habitat. Operational effects of launch-related sonic booms are expected to produce minor impacts to Channel Islands wildlife. These impacts would be the same from all four sites.

Local (South VAFB) and regional (Lompoc, Santa Maria) water resources would be affected by ground water withdrawal from direct project construction and operations needs and from domestic use by project construction and operations personnel and their families. Ground water basins supplying the local and regional environments are independent from one another. Increases in withdrawal from the local aquifer would be expected to be about 380 acre-feet per year during the anticipated four-year construction phase at the Cypress Ridge, Boathouse Flats, and Vina Terrace sites and 45 acre-feet per year for operations at all of the sites. Construction at SLC-6 would minimize water consumption, as there would be less demand for water for dust control, the primary use of water during construction. Overall, effects to the local ground water basin from construction are expected to be minor.

The long-term effect from operations could be significant. The projected 17 percent increase in demand due to project operations could result in an overdraft condition of the local aquifer, a potentially significant effect. Withdrawals from the aquifers supplying water to the regional environment are dependent on the number of project personnel and would, therefore, be the same for all four sites during operations. Regional demand for water would be expected to increase by

approximately 305 acre-feet per year, or 0.2 percent over existing rates. The regional aquifers are currently in an overdraft condition. Therefore, the anticipated increase in water use would be significant, based on the long-term operational demand related to the proposed project.

Potential air quality impacts during construction at the Cypress Ridge, Vina Terrace, or Boathouse Flats site would primarily be dust from earth moving operations and would be mitigated by onsite watering. Potential construction impacts would be minimized by implementation of the proposed project at the SLC-6 site, since earth moving activities are not anticipated. During operations, there would be emissions of fuel and oxidizer vapors, plus combustion products such as CO, SO_2, NO_x, and HC. These emissions would be minor and infrequent and, therefore, insignificant.
The greatest source of emissions would be from vehicle launch, primarily HCl and Al_2O_3 from combustion of the SRMUs, and CO and NO_x from combustion of hypergolic fuels. Standard VAFB launch operational procedures would result in minimum migration of pollutants into inland uncontrolled areas near VAFB. The potential for vehicle failure would produce similar emissions. Studies indicate that the short duration and intermittent nature of proposed activities would not measurably affect air quality. Impacts to air quality from operations would be the same for the proposed and alternative sites. Noise would occur primarily from normal launch events and result in noise levels of about 100 dBA at Lompoc and 90 dBA at Santa Maria, persisting for about 60 seconds for a maximum of three launches per year. Due to its short duration, such noise would not be significant. Noise impacts would be the same from the proposed and alternative sites.

Visual impacts would result from conversion of the Cypress Ridge, Boathouse Flats, or Vina Terrace sites from undeveloped open space to an active, industrial-type use. On a local basis, the proposed action would be a southerly extension of an existing array of space launch complexes and so would not be a unique visual feature. Due to the context in which it would be visible, and the limited number of persons involved, these impacts are not considered significant. Implementation of the proposed action at the SLC-6 site would result in the least visual impact since the site has already been fully developed and is part of the viewer's set of existing expectations. Changes made to accommodate the Titan IV/Centaur program would be visually minimal.

Regional impacts to historic and prehistoric cultural resources are not expected from implementation of the project at any site. However, the caliche plant fossils on San Miguel Island may be affected by the shock from launch-induced sonic booms, regardless of which alternative is chosen. Within the proposed project vicinity, there could be effects to the historic former U. S. Coast Guard Rescue Station (Boathouse), to archaeological sites which preliminary studies indicate

may be eligible for inclusion in the National Register, and to a prehistoric Chumash rock art site. Disturbance to archaeological resources would occur primarily from grading and trenching activities at the Cypress Ridge, Boathouse Flats, and Vina Terrace sites. These potential impacts would be mitigated through avoidance by design, a pre-project data recovery program, and onsite construction monitoring. Implementation of the proposed action at SLC-6 would minimize the potential for impacts to buried archaeological resources since no excavation or earth moving activities are anticipated.

The extent of potential socioeconomic effects would depend on the number of persons who move to the area for the employment opportunities provided by the proposed project. This new population would increase demands for housing, public services, and utilities, primarily in Lompoc and Santa Maria. Assuming maximum impacts, population could increase by 1,440 in the North County area during construction at Cypress Ridge, Boathouse Flats, or Vina Terrace, and by 1,470 during operations. Implementation of the proposed action at SLC-6 would result in a smaller population increase during project construction (approximately 790 persons). In general, these impacts are expected to be beneficial to the growing North County area. Accordingly, the beneficial impacts from construction of the proposed project at SLC-6 would be less than if one of the other sites were selected, as fewer construction personnel would be required. No mitigation measures are proposed. Potential transportation impacts to regional streets and highways also would occur as a result of additional construction and operations workers who may move to the area for employment. There also could be delays in entering VAFB due to additional traffic at the Main and South Gates. These impacts would not be significant for implementation of the proposed project at any of the four sites, and no mitigations are proposed.

Land use and recreation impacts would occur as a result of activities being disrupted by launch events from any of the four potential sites. These impacts primarily would be to offshore oil and gas extraction and shoreline and marine recreation. Such interruption would result from Titan IV/Centaur launches a maximum of three times per year and would not be significant. Initial concerns were that agricultural areas having potential for residential use in areas south of VAFB could be affected by launches from the proposed project. However, in independent action, the USAF has proposed a study of the possibility of purchasing potentially affected areas, thereby minimizing the potential for impacts to these areas.

Project implementation would result in the generation of domestic, industrial, and hazardous waste. The generation of domestic wastes during construction would be greater at an undeveloped site, as a greater number of construction personnel would be required there than at SLC-6.

Domestic waste during operations would be the same for the four potential sites. It is anticipated that the SLC-6 alternative would produce greater construction debris due to demolition activities. There are storage and treatment facilities available on VAFB and in the project region with the capacity to routinely accommodate construction debris and domestic and industrial wastes. Therefore, these wastes would not create a significant impact. It is estimated that 119 tons of hazardous waste per year would be generated due to operations at the proposed and alternative sites and require appropriate treatment or disposal. This would be less than 0.02 percent of the approximately 576,000 tons of hazardous waste disposed of in California in 1987 (CDHS 1989). In addition, it is estimated that implementation of the proposed action at the SLC-6 site would generate an additional 80,000 gallons of hazardous waste due to the necessity to replace hypergolic fuel and oxidizer delivery systems. Disposal of construction and operational waste at an appropriate facility would incrementally shorten the facility's useful life and so is considered adverse. No mitigations for waste management are proposed.

Potential health and safety impacts are related to the possible occurrence of an accident, primarily related to hypergolic propellant transportation/storage and/or transportation and preparation of solid rocket motor upgrade (SRMU) segments. Rupture of hypergolic storage vessels could result in the release of toxic gases and the possibility of explosion. Hypergolic propellants have been shipped to VAFB since 1958, with no major accidents. An SRMU accident could result in ignition of the propellant and subsequent release of HCl, Al_2O_3, and heat, with subsequent adverse health effects. Impacts related to either a normal or aborted launch are not expected to significantly affect the public, and no mitigation measures are proposed.

CONCLUSIONS

Based on the extensive evaluation presented in this Draft EIS, there would be fewer environmental impacts associated with reconfiguration of SLC-6 than with development of either the proposed Cypress Ridge site or the Boathouse Flats or Vina Terrace alternatives.

This conclusion is based on the comparison of direct and cumulative impacts and the evaluation of mitigation measures proposed to minimize and/or alleviate the direct impacts (see Table 2.3.1 and Sections 2.4, 2.5). This comparison of impacts and mitigation measures shows that, for the four sites evaluated, most environmental impacts would not be considered significant after mitigation measures were implemented. However, many of those impacts would not occur, and most others would occur on a smaller scale, if the proposed action occurred at SLC-6 rather than at one of the undeveloped sites.

Implementation of the proposed action at SLC-6 would involve extensive site demolition, modification, and construction activities. However, additional excavation or ground clearing is not anticipated, as the proposed activities would occur within areas that have been previously disturbed. Therefore, compared to the undeveloped sites, implementing the SLC-6 alternative would result in less soil loss from construction and less impact to borrow and spoil sites.

Further, with the SLC-6 alternative, impacts to vegetation and special interest plants would be significantly less, since ground clearing activities are not planned. There also would be less impact to animal habitat and individuals and to sensitive animal species. In addition, since most major facility components are already built at SLC-6, there would be less visual impact than with the development of one of the other sites.

However, implementation of the SLC-6 alternative would result in greater generation of liquid hazardous waste, due to necessary modifications to the hypergolic fuel and oxidizer delivery systems prior to use for the Titan IV/Centaur. Also, because fewer personnel would be required for construction activities at SLC-6 than at an undeveloped site, there would be fewer economic benefits generated in the regional impact area during the project construction period.

Previously, the SLC-6 site was the subject of the USAF Environmental Impact Analysis Process which addressed modification of the Manned Orbital Laboratory facilities at the site to accommodate the Space Shuttle. As a result of that process, a Final Environmental Impact Statement (EIS) for the Space Shuttle Program at VAFB was issued in January 1978, with a Supplement to the Final EIS following in July 1983. Those documents addressed the construction and operation of Space Shuttle facilities at VAFB and Port Hueneme, California, activities similar to those which would occur with implementation of the proposed Titan IV/Centaur program. The implementation of the Space Shuttle program addressed in those documents would have generated greater impacts to most resources than those expected to result from the Titan IV/Centaur program now being evaluated for that site.

Overall, the reconfiguration of SLC-6 for the Titan IV/Centaur program would result in fewer environmental impacts than would implementation of the proposed project at one of the three undeveloped sites.

1.0 INTRODUCTION

The purpose of this Draft Environmental Impact Statement (EIS) is to identify and evaluate potential environmental impacts of a proposed action involving the construction and operation of a proposed Space Launch Complex 7 (SLC-7) for the Titan IV/Centaur at Vandenberg Air Force Base (VAFB), California.

1.1 EIS PROCESS

This Draft Environmental Impact Statement has been prepared in accordance with: (1) the National Environmental Policy Act (NEPA), as implemented by Executive Order 11514, 42 USC 4321, (2) the President's Council on Environmental Quality (CEQ) Regulations, Title 40 Code of Federal Regulations (CFR), Part 1500 *et seq.*, and (3) USAF Regulations 19-1, 19-2, 19-7, and 19-9, which constitute USAF directives for compliance with NEPA.

The following briefly summarizes the EIS process as it relates to the proposed SLC-7 project:

- Notice of Intent to Prepare an EIS - The Notice of Intent for the proposed action is prepared and published in the Federal Register, as well as in local newspapers in the region of the proposed project. Publication occurred on April 8, 1988, for the proposed Titan IV/Centaur SLC-7 project.

- Public Scoping Meetings - Public scoping meetings are held to solicit input from interested individuals, groups, agencies, and elected officials. Items or issues to be addressed in the Draft EIS were compiled from both oral and written statements. These meetings are announced by: (1) publishing the Notice of Intent in the Federal Register, (2) letters to agencies, public officials, and public interest groups, (3) providing legal notices in local and regional newspapers, and (4) a USAF official news release to local and regional news media. These meetings were held on May 3 and 5, 1988, for the proposed Titan IV/Centaur SLC-7 project.

- Preparation of the Draft EIS - A Draft EIS is prepared that identifies, describes, and analyzes the environmental issues of the proposed action and alternatives.

- Public Release of the Draft EIS for Review and Comment - The Draft EIS is released for review for 45 days to the public, including interested individuals, groups, government representatives, and agencies.

- Public Hearing - A public hearing is held during the 45-day Draft EIS review period to provide the public with an opportunity to verbally comment on the Draft EIS.

- Preparation of the Final EIS - A Final Environmental Impact Statement (FEIS) is prepared. The FEIS incorporates and responds to public comments received as a result of public review of the Draft EIS.

- Record of Decision - After publication of the FEIS and a 30-day waiting period, the USAF makes its decision regarding the proposed action, prepares a concise public record on the decision, and publishes the decision in the Federal Register.

1.2 DRAFT EIS FORMAT

The contents of the Draft EIS are arranged to provide a clear and accurate description of the proposed action and alternatives, the potential consequences of implementation, and the environmental evaluation process.

The Draft EIS is organized under the following primary headings:

- 1.0 Introduction
  - This chapter introduces the proposed action, explains the EIS process, including scoping, and provides a framework for understanding the complexity of regulatory compliance requirements associated with the proposed action.
- 2.0 The Proposed Action and Alternatives
  - This chapter provides a detailed description of the proposed action and alternatives and comparative summaries of individual and cumulative impacts and mitigation measures.
- 3.0 Affected Environment
  - This chapter provides a baseline description of the natural and man-made environment that would be affected by the proposed action and alternatives.
- 4.0 Environmental Consequences and Mitigation Measures
  - This chapter discusses the potential impacts resulting from implementation of the proposed action and alternatives. Mitigation measures to reduce or avoid potential impacts are proposed for consideration by decision-makers. This chapter also includes discussions of short-term versus long-term uses of the environment, commitments of resources required for implementation of the proposed action, and unavoidable adverse effects.
- 5.0 List of Preparers
  - This chapter identifies individuals and organizations responsible for producing the Draft EIS.
- 6.0 Individuals and Agencies Contacted
  - This chapter provides a list of individuals and organizations contacted during preparation of the Draft EIS.

- 7.0 List of Recipients of Draft EIS
  - This chapter provides reference to the circulation of the Draft EIS.
- 8.0 References
  - This chapter provides the list of materials referenced in the text of the Draft EIS.
- 9.0 List of Abbreviations
  - This chapter provides the list of abbreviations and acronyms referenced in discussions of the proposed action and alternatives.
- Appendices
  - The appendices contain relevant supporting documentation to the Draft EIS.

1.3 PURPOSE AND NEED FOR THE PROPOSED ACTION

The purpose of the proposed Titan IV/Centaur SLC-7 at VAFB is to fulfill these needs: (1) support timely and reliable launch of critical DOD satellites from a location from which highly inclined and polar orbits can be safely achieved, (2) provide capability to launch payloads in the 10,000-pound class to high energy, inclined orbits, and (3) maintain assured access to space by providing backup launch capability for the Titan IV/Centaur and Titan IV/NUS space launch vehicles.

The Titan IV/Centaur configuration requires a specific launch pad design with associated support facilities. These facilities exist at Cape Canaveral Air Force Station (AFS) in Florida. Launches from Cape Canaveral, however, are constrained to easterly launch azimuths between 35 and 120 degrees. Consequently, polar orbits cannot safely be achieved.

As shown in Figure 1.3.1 (Over-Water Launch Azimuths), the Pacific coast location of VAFB permits space launch azimuths of 150 to 201 degrees, allowing polar and other high inclination orbits. These orbits provide coverage perpendicular to the equator of the entire planet, as required for defense, weather, and earth resources surveillance, communications relay, navigational systems, and other scientific purposes. Another important type of high inclination mission is the sun-synchronous mission where the satellite orbit maintains its initial orientation relative to the sun.

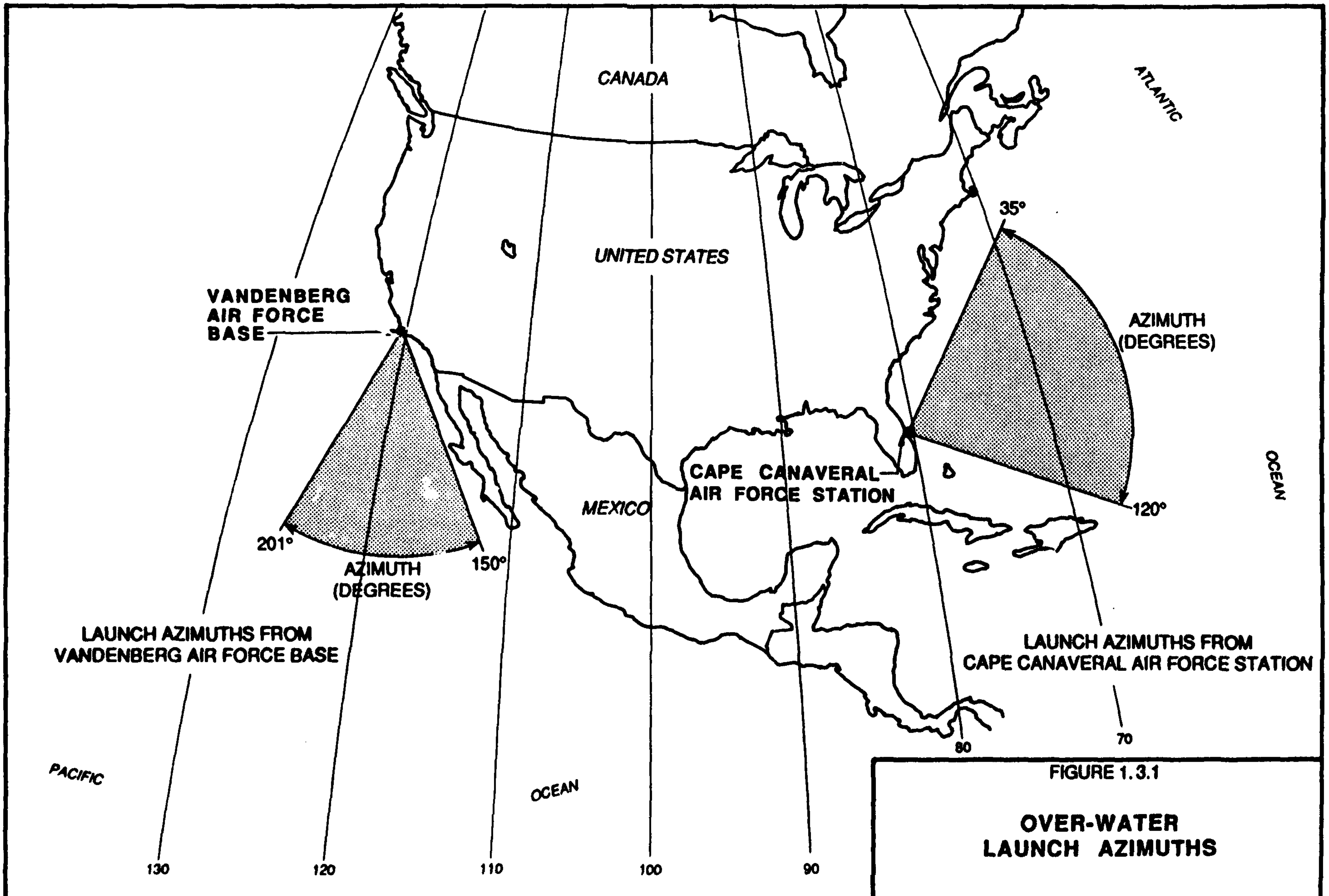


FIGURE 1.3.1

OVER-WATER LAUNCH AZIMUTHS

1.4 SCOPING PROCESS

A public scoping process, as required by NEPA, was initiated to determine the scope of issues to be covered and the level of detail to which those issues should be addressed in this Draft EIS. The scoping process for the proposed action was designed to solicit comments from the public, state and local governments, and federal agencies and included: (1) publication of the Notice of Intent in the Federal Register, (2) direct mailing of a notice to prepare an EIS to potentially interested agencies and individuals, (3) publications in newspapers of local and regional circulation indicating the nature of the project, as well as the date, time, and location of public scoping meetings, and an address for written comments, and (4) two public scoping meetings, with one held in the local community and one at a regional location. Copies of the public notice, mailing list, and scoping documents are provided in Appendix A.

The scoping process culminated with two public meetings, one held on May 3, 1988, at Lompoc Civic Auditorium, 217 South "L" Street in Lompoc, California, and one on May 5, 1988, at Goleta Valley Community Center, 5679 Hollister Avenue, Goleta, California. The scoping meetings were conducted to provide an opportunity for the public and governmental agencies to submit oral and written comments on the issues to be addressed in response to a USAF presentation on the proposed action. Those not able to attend a public scoping meeting were invited through the published notifications to submit written comments to the USAF by May 17, 1988.

As a result of the scoping process, including public scoping meetings, contact with agencies and individuals, and oral and written comments from the scoping meetings, the primary issues of public concern were identified. These issues are summarized in Table 1.4.1 (SLC-7 Scoping Process, Summary of Issues) according to the type and number of comments received. The primary issues identified by individuals and agencies during the scoping process involve: (1) safety from operations and potential accidents, (2) potential recreational impacts that could result from closure of Jalama Beach County Park during space vehicle launch, and (3) air quality impacts.

TABLE 1.4.1

SLC-7 SCOPING PROCESS SUMMARY OF ISSUES

	Oral Comments	Written Comments	Total
SAFETY (including operations, accidents, propellant transport, and emergency response plans)	1	7	8
RECREATION (impact of operations on closure of Jalama Beach County Park and Ocean Beach County Park)	1	5	6
AIR QUALITY (impacts of toxic pollutants and operations emissions)	-	6	6
ALTERNATIVES (use of existing/alternate sites)	1	3	4
SOCIOECONOMICS (impacts on local employment, population, and housing)	1	3	4
VEGETATION/WILDLIFE (effects of toxic pollutants, noise, and habitat removal)	-	4	4
WATER RESOURCES (ground and surface water quality, ground water extraction)	-	3	3
LAND USE (compatibility with surrounding properties)	-	2	2
WASTE MANAGEMENT (disposal of hazardous/toxic wastes and wastewater)	-	2	2
CULTURAL RESOURCES	-	1	1
TRANSPORTATION	-	1	1

Note: Appendix A.6 contains responses to the written scoping comments and shows where each comment is addressed in the Draft EIS.

1.5 REGULATORY COMPLIANCE

This section summarizes the legislative and regulatory framework which, in addition to NEPA, and USAF Guidelines, would be addressed as part of the proposed action. Various aspects of the proposed action, as shown below, must be in compliance with applicable federal, state, and local environmental requirements prior to full implementation. These additional regulations apply to those aspects of the proposed action that could involve endangered species, cultural resources, coastal zone management, air quality, and water quality. For the proposed action, more than 20 different acts, codes, resolutions, and sets of agency rules and regulations have been identified.

1.5.1 ENDANGERED SPECIES

1.5.1.1 Federal Endangered Species Act

The Federal Endangered Species Act (ESA) of 1973, as amended, extends legal protection to plants and animals listed as endangered or threatened by the U.S. Fish and Wildlife Service (USFWS) and the National Marine Fisheries Service (NMFS). The ESA authorizes the USFWS and NMFS to review proposed federal actions to assess potential impacts to listed species. Section 7 of the ESA requires that a proposed major federal action be evaluated by the USFWS and/or the NMFS for its potential to affect listed species or critical habitat. In compliance with the "Section 7 Consultation" process, the USFWS and/or NMFS evaluates a biological assessment prepared by the federal agency proposing the action and issues a "biological opinion" as to whether the proposed action is likely to jeopardize listed species or critical habitat.

Listed species are those fish, wildlife, or plants that have been determined to be threatened (likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range) or endangered (in danger of extinction throughout all or a significant portion of its range) under Section 4 of the ESA and which have been the subject of final regulation and listing in the Federal Register. There are several federal categories for classifying the status of sensitive plant and wildlife species, those that have been determined to be threatened or endangered, plus two categories of candidate species. Category 1 (C1) species are those for which there is sufficient information to support listing as threatened or endangered, and Category 2 (C2) species are those that may be appropriate for listing, but for which current information is insufficient to justify such action. These C1 and C2 species are not afforded protection under the ESA, but are considered in the planning process of a major federal action.

1.5.1.2 Marine Mammal Protection Act

The Marine Mammal Protection Act (MMPA) of 1972 offers protection similar to the ESA to marine mammals. The MMPA authorizes the National Oceanic and Atmospheric Administration (NOAA), NMFS, to review proposed federal actions to assess potential impacts. Marine mammals also are included in Section 7 of the ESA and are part of the NMFS consultation process.

1.5.1.3 California Endangered Species Act and Native Plant Protection Act

The California Endangered Species Act (CESA) of 1984 and the Native Plant Protection Act (NPPA) of 1977 are administered by the California Department of Fish and Game (CDFG). These acts address Rare, Endangered, and Candidate Species of plants and wildlife. Candidate Species are those that have been accepted by the state for review and potential inclusion to the list of Threatened or Endangered Species. The designation of "rare" applies to plants only, specifically those that are not threatened or endangered but could be, due to decreasing numbers or further restrictions to habitat. The CDFG utilizes and maintains the California National Diversity Data Base to track the status of these "sensitive" species as designated by state agencies. While the USAF is not obligated to protect state-listed threatened or endangered species, it is USAF policy to work cooperatively with the CDFG to do so.

1.5.1.4 Status of Proposed Action

Informal consultation with the USFWS and NMFS was initiated by submittal of a list of species to be included in the environmental analysis. Their comments have been received and are addressed within this Draft EIS. They are discussed in detail in the SLC-7 Biological Assessment (Environmental Solutions 1989b). In compliance with the requirements of Section 7 for formal consultation, the Biological Assessment was submitted to USFWS and NMFS concurrently with the Draft EIS.

1.5.2 CULTURAL RESOURCES

1.5.2.1 National Historic Preservation Act (Section 106)

The National Historic Preservation Act (NHPA) of 1966, as amended, was established to protect significant historic and prehistoric resources. The NHPA: (1) established a National Register of Historic Places to be maintained by the Secretary of the Interior, (2) authorized each state to

establish the office of State Historic Preservation Officer (SHPO), and (3) established the Federal Advisory Council on Historic Preservation (ACHP). Section 106 of the act requires federal agencies to provide SHPO and the ACHP an opportunity to comment on any federal undertaking within their state that would affect properties included in or eligible for inclusion in the National Register.

National Register eligibility criteria specify that the quality of significance in American history, architecture, archaeology, and culture is present in districts, sites, buildings, structures, and objects of national, state, or local importance that possess integrity of location, design, setting, materials, workmanship, feeling, association, and the following:

- are associated with events that have made a significant contribution to the broad patterns of history; or
- are associated with the lives of people significant in our past; or
- embody the distinctive characteristics of a type, period, or method of construction, or that represent a significant and distinguishable entity whose components may lack individual distinction; or
- have yielded or are likely to yield information important in prehistory or history.

The Advisory Council Regulations, "Protection of Historic and Cultural Properties," (36 CFR 800: Federal Register, Vol. 51, No. 169, September 2, 1986) outline procedures to be followed by federal agencies. Federal agencies are required to consult with the SHPO to determine if a proposed undertaking encompasses any property included in, or eligible for inclusion in, the National Register of Historic Places. For each eligible property identified, the federal agency must determine if the proposed undertaking would have an effect. If there could be an effect, the National Register criteria will be applied to determine whether the effect would be adverse. The regulations provide for consultation with the SHPO and ACHP to develop conditions as the basis for mitigation of potential adverse effects.

The Advisory Council Regulations encourage participation by local governments, Native American tribes, and the public (36 CFR 800.1 [c] [2]). Within this context, comments on the SLC-7 project are sought from the California Coastal Commission, Santa Barbara County, the Native American Heritage Commission, the Elders Council of the Santa Ynez Reservation, the Coastal Band of the Chumash Nation, local archaeologists, historians, and other groups or individuals concerned with cultural resources.

1.5.2.2 National Environmental Policy Act

The National Environmental Policy Act (NEPA) states that it is national policy to "preserve important historic, cultural, and natural aspects of our national heritage, and maintain, wherever possible, an environment which supports diversity and variety of individual choice" (Section 101[b] 4). The range of cultural resources protected by NEPA is broader than that provided by legislation protecting historic sites.

The CEQ Regulations, which implement NEPA, state that public participation is considered important to ensure identification of cultural resources. Section 1501.7(a) (1) of the regulations requires that the NEPA lead agency, "invite the participation of affected federal, state, and local agencies, any affected Indian Tribes, the proponents of the action, and other interested persons."

1.5.2.3 American Indian Religious Freedom Act

The American Indian Religious Freedom Act of 1978 (P. L. 95-341; 92 Stat. 470) states that it is the policy of the United States to protect and preserve for American Indians their inherent right of freedom to believe, express, and exercise their traditional religions, including, but not limited to access to sites, use and possession of sacred objects, and the freedom to worship through ceremonials and traditional rites. The requirements of this act should be taken into account when considering the disposition of Native American heritage sites.

1.5.2.4 Status of Proposed Action

The SLC-7 Environmental Impact Analysis Process (EIAP) has included an intensive cultural resources inventory of areas that could be disturbed by the proposed action or alternatives. This inventory is a surface investigation to locate objects that may indicate the presence of buried subsurface deposits. The surface investigation was performed by a team of researchers walking over the entire area designated for the study in a series of transects spaced at 10-meter intervals. The cultural resources inventory, which forms the basis for the analysis in this Draft EIS, and for further investigation and potential submittal of Eligibility and Effects documentation to the SHPO, was completed in accordance with the Section 106 consultation process.

The USAF has initiated informal Section 106 consultation with SHPO to describe the proposed action and procedures for dealing with known and anticipated cultural resources. Specifically discussed were activities completed to date and those that will be completed in the future.

In addition, subsurface investigations will be conducted in order to determine the eligibility of, and effect to, potential sites indicated by results of the surface inventory. The required eligibility and effects documents will be prepared for formal consultation with SHPO and the Advisory Council.

1.5.3 COASTAL ZONE MANAGEMENT

1.5.3.1 Coastal Zone Management Act

The Federal Coastal Zone Management Act of 1972, as amended (P. L. 92-583), implemented by the National Oceanic and Atmospheric Administration, requires that a Coastal Consistency Determination be submitted by the USAF. This document is required to be submitted to the appropriate local agency with coastal jurisdiction. For the state of California, this agency is the California Coastal Commission (CCC). The purpose of the Coastal Consistency Determination is to assure that proposed undertakings by federal agencies are consistent to the "maximum extent practicable" with the state's coastal management program.

1.5.3.2 Status of Proposed Action

The USAF has informally met with the staff of the CCC to discuss effects of the proposed project with regard to the state's Coastal Management Program. Concurrent with this Draft EIS, a SLC-7 Coastal Consistency Determination has been prepared and submitted to the CCC (Environmental Solutions 1989c).

1.5.4 AIR QUALITY

Construction and operation of SLC-7 will be subject to federal, state, and local rules and regulations, as implemented through provisions of the Clean Air Act of 1970, as amended (42 U.S.C. 7401 *et seq.*), pertaining to the control of air pollutants emitted to the atmosphere. Region IX of the U.S. Environmental Protection Agency (EPA) in San Francisco, California, has federal jurisdiction over the area. The California Air Resources Board (CARB) is responsible at the state level. At the local level, the Santa Barbara County Air Pollution Control District (SBCAPCD) has authority over sources of air pollutants emitted in the area.

The CARB serves as a technical review and advisory agency, providing technical advice to SBCAPCD when necessary, and offering guidance when SBCAPCD regulations are not sufficiently detailed to address a particular problem. Under the provisions of the Clean Air Act, SBCAPCD has fulfilled federal requirements that allow a local agency to administer Federal Clean Air Act policies. Thus, SBCAPCD will have primary regulatory review authority over potential sources of air pollution associated with the proposed action.

1.5.4.1 Ambient Air Quality Standards and Attainment Status of North Santa Barbara County

The Clean Air Act was established in an effort to ensure that minimum levels of air quality are maintained in all areas of the United States. These minimum levels were based upon health-related exposure levels and were termed "National Ambient Air Quality Standards" (NAAQS). The NAAQS are legal limits on the allowable ambient levels of air pollution, and they specify the maximum allowable concentration of a pollutant or a class of pollutants in the atmosphere and thus characterize the amount of exposure deemed safe to the public. Pollutants for which NAAQS have been established are nitrogen dioxide (NO_2), sulfur dioxide (SO_2), carbon monoxide (CO), suspended particulate matter less than 10 microns in aerodynamic diameter (PM_{10}), reactive organic compounds (ROC), and ozone. These are often termed "criteria pollutants."

There are primary and secondary NAAQS, as shown in Table 1.5.1 (Ambient Air Quality Standards). The primary standards are intended to reflect levels of air quality and include an adequate margin of safety deemed necessary to protect the public health. Most areas of the United States were required to attain the primary standards no later than December 31, 1982, with conditional extensions to 1987 granted to certain "problem" areas. Areas found to be in violation of the primary standards were termed "nonattainment areas." The secondary standards reflect the levels of air quality necessary to protect public welfare from any other known or anticipated adverse effects of a pollutant.

Under the Clean Air Act, state and local authorities were given primary responsibility for assuring that their respective regions were in attainment of, or had a verifiable plan to attain, the NAAQS. This provision also gave state and local agencies authority to promulgate more stringent ambient air quality standards should they desire. In California, CARB has promulgated its own set of California Ambient Air Quality Standards (CAAQS) (see Table 1.5.1). There is no deadline for attainment of the CAAQS. To date, SBCAPCD has not adopted any ambient air quality standards more stringent than the CAAQS.

TABLE 1.5.1

AMBIENT AIR QUALITY STANDARDS

POLLUTANT	AVERAGING TIME	CALIFORNIA STANDARDS		NATIONAL STANDARDS		
		CONCENTRATION	METHOD	PRIMARY	SECONDARY	METHOD
Oxidant	1 Hour	0.09 ppm (180 ug/m3)	Ultraviolet Photometry	—	—	—
Ozone	1 Hour	—	—	0.12 ppm (235 ug/m3)	Same as Primary Standards	Ethylene Chemiluminescence
Carbon Monoxide	8 Hour	9.0 ppm (10 mg/m3)	Non-dispersive Infrared Spectroscopy (NDIR)	9 ppm (10 mg/m3)	Same as Primary Standards	Non-dispersive Infrared Spectroscopy (NDIR)
	1 Hour	20 ppm (23 mg/m3)		35 ppm (40 mg/m3)		
Nitrogen Dioxide	Annual Average	—	Gas Phase Chemiluminescence	0.05 ppm (100 ug/m3)	Same as Primary Standards	Gas Phase Chemiluminescence
	1 Hour	0.25 ppm (470 ug/m3)		—		
Sulfur Dioxide	Annual Average	—	Ultraviolet Fluorescence	0.03 ppm (80 ug/m3)	—	Pararosoaniline
	24 Hour	0.05 ppm (131 ug/m3)		0.14 ppm (365 ug/m3)	—	
	3 Hour	—		—	0.5 ppm (1300 ug/m3)	
	1 Hour	0.25 ppm (655 ug/m3)		—	—	
Suspended Particulate Matter (PM_{10})	Annual Geometric Mean	30 ug/m3	Size Selective Inlet High Volume Sampler	50 ug/m3	—	—
	24 Hour	50 ug/m3		150 ug/m3		
Sulfates	24 Hour	25 ug/m3	Turbidimetric Barium Sulfate	—	—	—
Lead	30 Day Average	1.5 ug/m3	Atomic Absorption	—	—	Atomic Absorption
	Calendar Quarter	—		1.5 ug/m3	Same as Primary Standards	
Hydrogen Sulfide	1 Hour	0.03 ppm (42 ug/m3)	Cadmium Hydroxide STRactan	—	—	—
Vinyl Chloride (chloroethene)	24 Hour	0.010 ppm (26 ug/m3)	Tedlar Bag Collection, Gas Chromatography	—	—	—
Visibility Reducing Particles	1 Observation	In sufficient amount to reduce the prevailing visibility to less than ten miles when the relative humidity is less than 70 percent.		—	—	—

Source: California Air Resources Board 1987.

Areas that do not attain the NAAQS are required by the Clean Air Act to prepare "Air Quality Attainment Plans" (AQAPs) in order to formulate a program of controls for existing and proposed sources of air pollutant emissions, such that attainment of the NAAQS may be attained by a certain target date.

VAFB is located in northern Santa Barbara County. Historically, this area has been in attainment of both NAAQS and CAAQS. However, 1986 and 1987 ambient air quality monitoring data indicate that the region is no longer in attainment of NAAQS for ozone, a secondary pollutant generated from the photochemical reaction of nitrogen oxides (NO_x) and reactive organic compounds (ROC). In addition, SBCAPCD officials have recently indicated that sufficient data exist to demonstrate violation of the CAAQS for PM_{10}. Recent studies in the state of California have demonstrated that PM_{10}, in addition to direct emissions of windblown dust and fuel combustion-related emissions, can also be a secondary pollutant resulting from photochemical aerosol. It should be noted that northern Santa Barbara County will continue to be a federal attainment area for ozone and PM_{10} until the EPA approves redesignation to nonattainment.

Unlike those of most other air pollution control districts, SBCAPCD regulations specify that a "nonattainment" condition exists when any state or federal (whichever is more stringent) ambient air quality standard is violated. In keeping with this policy, in 1987, SBCAPCD declared North Santa Barbara County as being in nonattainment for ozone, due to violation of NAAQS for ozone. NO_x and ROC were also declared nonattainment pollutants because they are precursors to ozone formation. In addition, it is anticipated that SBCAPCD will soon declare North Santa Barbara County also to be in nonattainment for PM_{10} due to the violation of CAAQS for this pollutant. It is expected that SO_x will also be declared nonattainment because it is a precursor component of PM_{10}. The implications of these recent nonattainment designations will be significant with respect to their impact upon obtaining air quality permits for the construction and operation of SLC-7, as discussed in the following sections.

1.5.4.2 SBCAPCD Rules and Regulations

The SBCAPCD is empowered to regulate sources of air pollutant emissions in such a manner that the region within its jurisdiction either attains or is projected to attain the NAAQS for all criteria pollutants. Should it become clear that any part of that region is moving away from attainment of the standards, SBCAPCD will implement corrective measures to bring the region back into attainment. These could include measures such as: (1) lowering the Net Emission Increase

trigger levels, (2) more stringent air pollution control regulations for a new emission source, or (3) making regulations retroactive in certain instances and requiring existing emission sources to conform to them.

As a method to inventory all sources of air pollutant emissions, SBCAPCD Rule 201 requires that:

> ...Any person building, erecting, altering, or replacing any article, machine, equipment, or other contrivance, the use of which may cause the issuance of air contaminants or the use of which may eliminate or reduce or control the issuance of air contaminants, shall first obtain authorization for such construction from the Control Officer...

Therefore, any device that emits or controls the emission of air contaminants to the atmosphere must obtain an "Authority to Construct" (ATC) permit from the SBCAPCD before it can be built. Once a unit has been constructed and verified to be in compliance with SBCAPCD regulations, a Permit to Operate (PTO) is issued.

Emission increases from permitted sources of nonattainment air pollutants are addressed by SBCAPCD via a procedure termed "New Source Review" (NSR). Under NSR guidelines, Best Available Control Technology (BACT) is required for any net emissions increase of 2.5 pounds per hour for any nonattainment pollutant, and an Air Quality Impact Analysis (AQIA) is required for any net emissions increase in excess of five pounds per hour. Should the AQIA demonstrate violation of any ambient air quality standards, or interference with attainment, or should the net emissions increase be in excess of 10 pounds per hour, emission offsets will be required to demonstrate that there will be a "net benefit" to air quality resulting from construction of the new source.

An AQIA consists of using an air quality model to estimate the downwind impact that may result from proposed sources of air pollution. Results of air quality modeling are added to existing background air quality concentrations to determine whether the projected emissions would contribute to violations of ambient air quality standards. Required input to air quality models includes: (1) meteorological data that are representative of the area in which the proposed sources would be located, and (2) background air quality concentrations as derived from actual monitoring data in an area determined to be representative. If these data are not representative, one year of pre-construction meteorological and air quality data would be required before air quality modeling

could be performed. By imposition of the above pre-construction review guidelines, SBCAPCD officials hope to assure progress toward attainment of ambient air quality standards, while allowing economic expansion to occur in the region.

1.5.4.3 Permitting of SLC-7 Air Pollution Sources

The SBCAPCD regulations apply only to stationary sources of air pollution. Therefore, the launch of a space vehicle is exempted from the permitting process. This exemption, however, does not include operational support facilities and their corresponding control equipment. Under SBCAPCD regulations, equipment anticipated to be part of the SLC-7 air quality permitting process includes the following:

- Fuel Vapor Control System (either incinerator or scrubber)
- Oxidizer Vapor Control System (either incinerator or scrubber)
- Hydrogen Flares
- Emergency Power Generation System
- Propane Tank
- Propellant Storage Tanks
- Boilers

Certain existing facilities at different locations at VAFB will be shared by the existing and Titan IV programs. These facilities either are already permitted or are in the permitting process and include:

- Booster Vehicle Receipt and Processing - Building No. 8401
- Solid Rocket Booster Receiving, Refurbishment, and Subassembly Building - Building No. 398
- Payload Fairing Receipt and Processing - Building No. 8337
- Payload Receipt and Processing - Existing VAFB Facility
- Launch Control Center - Building No. 8510
- Hypergolic Propellant Stockpile Facilities - Buildings No. 975 and 977
- STS Power Plant - Building No. 536 (Authority to Construct received, Permit to Operate pending)

The existing permits are expected to be adequate to cover the addition of SLC-7 operations, with the exception of the Payload Fairing Receipt and Processing Facility - Building No. 8337. It is expected that this facility would require a revised permit due to increased use of its paint spray booths.

It is estimated that air contaminant emissions resulting from SLC-7 operations would be of sufficient magnitude to trigger SBCAPCD requirements for New Source Review (NSR), Best Available Control Technology (BACT), Air Quality Impact Analysis, and offsetting of emissions increases associated with operation of SLC-7. Although NSR will be triggered for SLC-7, permitting of the facility is anticipated to be routine, as no major sources of air pollutant emissions are planned for the facility.

1.5.4.4 Status of Proposed Action

SBCAPCD guidelines for compilation of an ATC permit application require the applicant to acquire at least one year of meteorological and air quality data which are descriptive of the preconstruction environment at the proposed project location. In January 1989, the SBCAPCD determined that existing meteorological and air quality data presently collected at Point Arguello, Jalama Beach, and SLC-6 would satisfy its preconstruction monitoring requirements.

VAFB has a large inventory of emission offset credits "banked" with SBCAPCD which, if available, could be applied against any emissions increases attributable to operation of SLC-7. Proposed sources of air pollutant emissions would be designed to comply with SBCAPCD guidelines for BACT.

The ATC application procedure for SLC-7 will be initiated as soon as sufficiently detailed system designs have been finalized and the necessary air quality analyses have been completed. The individual sources and characteristics of air pollutant emissions from operation of SLC-7 would not vary in relation to the eventual chosen siting alternative. SBCAPCD approval will be necessary before construction may commence on the facility.

1.5.5 WATER QUALITY

1.5.5.1 California Regional Water Quality Control Board, Resolution No. 83-12 and Order No. 83-60

The state of California Regional Water Quality Control Board (RWQCB), Central Coast Region, regulates all domestic wastewater treatment systems discharging effluent to the surface (including evaporation/percolation ponds), in accordance with the Central Coast Basin Plan dated March 14, 1975. Resolution No. 83-12 of the RWQCB covers amendments to the

Central Coast Basin Plan and contains specific recommendations for community sewage system design. Community systems are defined as having sanitary wastewater discharges of greater than 2,500 gallons per day (average daily flow). Certain larger sewage systems on VAFB, similar to those for the proposed SLC-7 project, are operated in accordance with RWQCB Order No. 83-60. The SLC-7 system would be sized for a wastewater discharge of about 36,000 gallons per day and designed in accordance with RWQCB Resolution No. 83-12 and Order No. 83-60.

1.5.5.2 Clean Water Act

The Clean Water Act, as amended (P. L. 92-500), is administered by the EPA, which delegates authority to the state Water Resources Control Board and, ultimately, to the RWQCB. The act defines the Primary and Secondary Standards for water quality. Treated water discharged to surface water or to the ocean is subject to the requirements of a National Pollution Discharge Elimination System (NPDES) permit, which in effect ensures that the water discharged meets drinking water quality standards at the point of discharge.

The Clean Water Act was amended in 1987, adding Section 319, requiring states to assess non-point source water pollution problems and to develop non-point source pollution management programs with controls to improve water quality. Non-point sources involve items such as surface runoff from streets, runoff from agricultural activities, runoff from construction activities, or percolation from such sources into the ground water. These recent revisions would require coordinating non-point source planning for the proposed project activities with the RWQCB.

Section 404 of the Clean Water Act states that a permit must be obtained in order to locate a structure, excavate, or discharge dredged or fill material into the navigable waters of the United States. Recent legislation and court decisions have expanded the definition of navigable waters to include marshes, swamps, and diked lands, even though they may not be truly navigable. The U.S. Army Corps of Engineers is responsible for issuing this permit.

1.5.5.3 California Porter-Cologne Water Quality Act

The California Porter-Cologne Water Quality Act defines a water quality control program for the state, which includes guidelines for long range resource planning, including programs for ground water, surface water, and reclaimed water. The Porter-Cologne Act is also designed to protect Coastal Marine water quality and to control discharges to wetlands, estuaries, and other biologically sensitive areas. This act is also administered by the RWQCB.

1.5.5.4 California Code of Regulations, Title 23

The California Code of Regulations (CCR), Title 23, Water, September 1985, Chapter 3, Subchapter 15, defines regulations for waste disposal to landfills, surface impoundments, and waste piles. Discharge to surface impoundments is further regulated by California Assembly Bill 1723 (Katz), which prohibits, beginning January 1, 1988, the discharge of hazardous wastes into new land treatment units unless the unit has been equipped with double liners, a leachate collection and removal system, and a ground water monitoring system. This prohibition will extend to all land treatment units, effective January 1990.

1.5.5.5 Toxic Pits Control Act

The Toxic Pits Control Act (TPCA) of 1984 requires that all surface impoundments containing liquid hazardous waste or hazardous waste containing free liquids be closed or retrofitted unless the owner applies for and receives an exemption. It also requires all owners to submit a hydrogeological assessment report for their impoundments. Retrofitting means installation of double liners, a leachate collection system, and monitoring devices. Provisions of the TPCA are jointly administered by the California Department of Health Services (DOHS) and the RWQCB.

1.5.5.6 Resource Conservation and Recovery Act

The Resource Conservation and Recovery Act (RCRA), 1976, Part 266, incorporates special standards for wastewater treatment units. CCR Title 22 - Environmental Health, Chapter 30, also sets minimum standards for the management of hazardous wastes and contains all the elements of RCRA. Title 22 is administered by DOHS and by the RWQCB.

1.5.5.7 Environmental Protection Agency (EPA)

The EPA has responsibility and authority under the Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA), the Superfund Amendment and Reauthorization Act of 1986 (SARA), commonly known as Superfund, and the National Contingency Plan (NCP). Generally, CERCLA provides that past and present owners of a site, as well as generators and transporters who contribute hazardous substances to a site, shall be liable for all costs of removal or remedial action that is undertaken by the U.S. government, a state, or any other person and for damages for loss of natural resources.

SARA enacted extra provisions and reinforces CERCLA in providing extra funding for long-term remedial measures to clean up specific sites that are a threat to human health and emphasizes the use of treatment technologies and meeting state requirements and standards of cleanup. The requirements of CERCLA and SARA apply to facilities owned or operated by the U.S. government. Executive Order 12580, Superfund Implementation, details how departments of the Executive Branch will comply with the requirements of CERCLA/SARA. In response to these requirements, USAF is currently pursuing Phase II of the Installation Restoration Program for VAFB (USAF 1988l).

1.5.5.8 Status of Proposed Action

A Hazardous Waste Assessment (Environmental Solutions 1989e) has been made of various space launch complexes and operations for which cumulative effects and joint use of existing waste facilities are anticipated. The assessment and informal meetings that have been held with the RWQCB assure that proposed SLC-7 activities and facilities would be in compliance with the various cited regulations. The provisions of CERCLA and SARA apply to past activities which may have occurred at potential SLC-7 sites.

1.5.6 FEDERAL PERMIT COMPLIANCE

In compliance with federal requirements, the following permit and regulatory requirements would need to be fulfilled prior to construction and operation of SLC-7:

PERMIT	AGENCY
• Certification of Environmental Impact Statement	U.S. Air Force
• Coastal Consistency Determination	California Coastal Commission
• Section 7 Consultation	U.S. Fish and Wildlife Service
	National Marine Fisheries Service
• Section 106 Compliance	State Historic Preservation Officer

Depending upon final project design and operational procedures, the following also may be necessary:

PERMIT	AGENCY
• NPDES Permit	Regional Water Quality Control Board
• Section 404 Permit	U.S. Army Corps of Engineers

2.0 THE PROPOSED ACTION AND ALTERNATIVES

2.1 PROPOSED ACTION

2.1.1 PROJECT OBJECTIVE

The U.S. Air Force (USAF) has proposed the construction and operation of a Titan IV/Centaur space launch complex in support of the Department of Defense (DOD) space program. The proposed action, known as Space Launch Complex 7 (SLC-7), would be located at Vandenberg Air Force Base (VAFB), California, and would be designed for a minimum operational period of 25 years.

The Titan IV/Centaur is an unmanned, expendable space launch vehicle capable of launching critical DOD satellites, including payloads in the 10,000-pound class, to high energy orbits. The proposed SLC-7 allows achievement of polar and highly inclined orbits. SLC-7 would be designed specifically to accommodate the Titan IV/Centaur, but would also be able to serve as a backup to other facilities for launch of the Titan IV/NUS (No Upper Stage) to assure access to space and timely and reliable launch of critical missions. The proposed SLC-7 facility represents the latest modification to the continuing Titan program at VAFB.

VAFB is assigned to the USAF Strategic Air Command (SAC). As host command, SAC's 1st Strategic Aerospace Division (1STRAD) is responsible for providing management, operational analysis, and material support for SAC and over 40 federal and civilian tenant agencies located at VAFB, as well as for controlling and conducting the SAC Intercontinental Ballistic Missile (ICBM) operational flight tests into the Western Test Range. VAFB provides extensive launch and technical support facilities to support the variety of space and missile systems that operate from the base.

A principal tenant of VAFB is the Space and Missile Test Organization (SAMTO), Air Force Systems Command (AFSC). Subordinate to SAMTO are the Eastern Space and Missile Center (ESMC) and Western Space and Missile Center (WSMC). ESMC is responsible for operating and maintaining the Eastern Test Range (ETR), while WSMC is responsible for operating and maintaining the Western Test Range (WTR). WSMC goals are to: (1) process and launch all U.S. polar orbiting satellites, utilizing Atlas, Titan, and Scout booster rockets, (2) conduct flight tests and evaluations of all new USAF ICBM systems, including Peacekeeper, Rail Garrison, modified

Minuteman, and Small ICBM, and (3) operate a national test range (WTR) in support of critical space programs, ICBM development, and aeronautical systems testing to assure essential telemetry, flight analysis, and range safety.

In addition to the Titan program, VAFB has been a base of operations for ongoing space launch activities associated with the Scout, Delta, Atlas, and Space Shuttle launch vehicle programs for over 25 years. Space Launch Complex 6 (SLC-6), the most recently constructed launch facility, was modified from its original configuration for the Manned Orbital Laboratory program for the Space Shuttle program, but has since been placed in mothball status relative to VAFB Space Shuttle launch activities. It is evaluated as an alternative site for the proposed action in Section 2.2 of this chapter. Other recent construction activities at VAFB have centered on Space Launch Complex 4 (SLC-4). SLC-4 East is being modified for processing and launch of the Titan IV/NUS. SLC-4 West has been modified and is currently an operational Titan II facility.

VAFB is located on a promontory along the California coast where space vehicles can be launched in southerly directions over the Pacific Ocean without overflying populated areas. These launch directions (azimuths) facilitate near polar (rather than equatorial) satellite orbits and sub-orbital westerly test and developmental flights of the ICBM. The ability to launch over unpopulated areas is necessary for the maintenance of a controlled launch safety program. VAFB provides the only location within the contiguous United States where hazards from southerly launches of large boosters can be maintained at acceptable levels. In general, the VAFB launch azimuths are complementary to the over-water launch azimuths available at Cape Canaveral Air Force Station and the National Aeronautic and Space Administration (NASA) Kennedy Space Center in Florida, which both provide for near equatorial satellite orbits.

2.1.2 PROJECT LOCATION AND ACCESS

As a result of feasibility analyses conducted by the USAF (URS Corporation 1987), it was recommended that the proposed SLC-7 project should be located on South VAFB, as shown in Figure 2.1.1 (Regional Location Map). One proposed and three alternative sites that could accommodate the facility were identified. The proposed site and two of the alternative sites are undeveloped, located within an area of South VAFB that is used primarily for grazing. The other alternative site is SLC-6, the launch complex modified for use with the Space Shuttle. Due to programmatic considerations, SLC-6 was not utilized for the Space Shuttle and is currently being

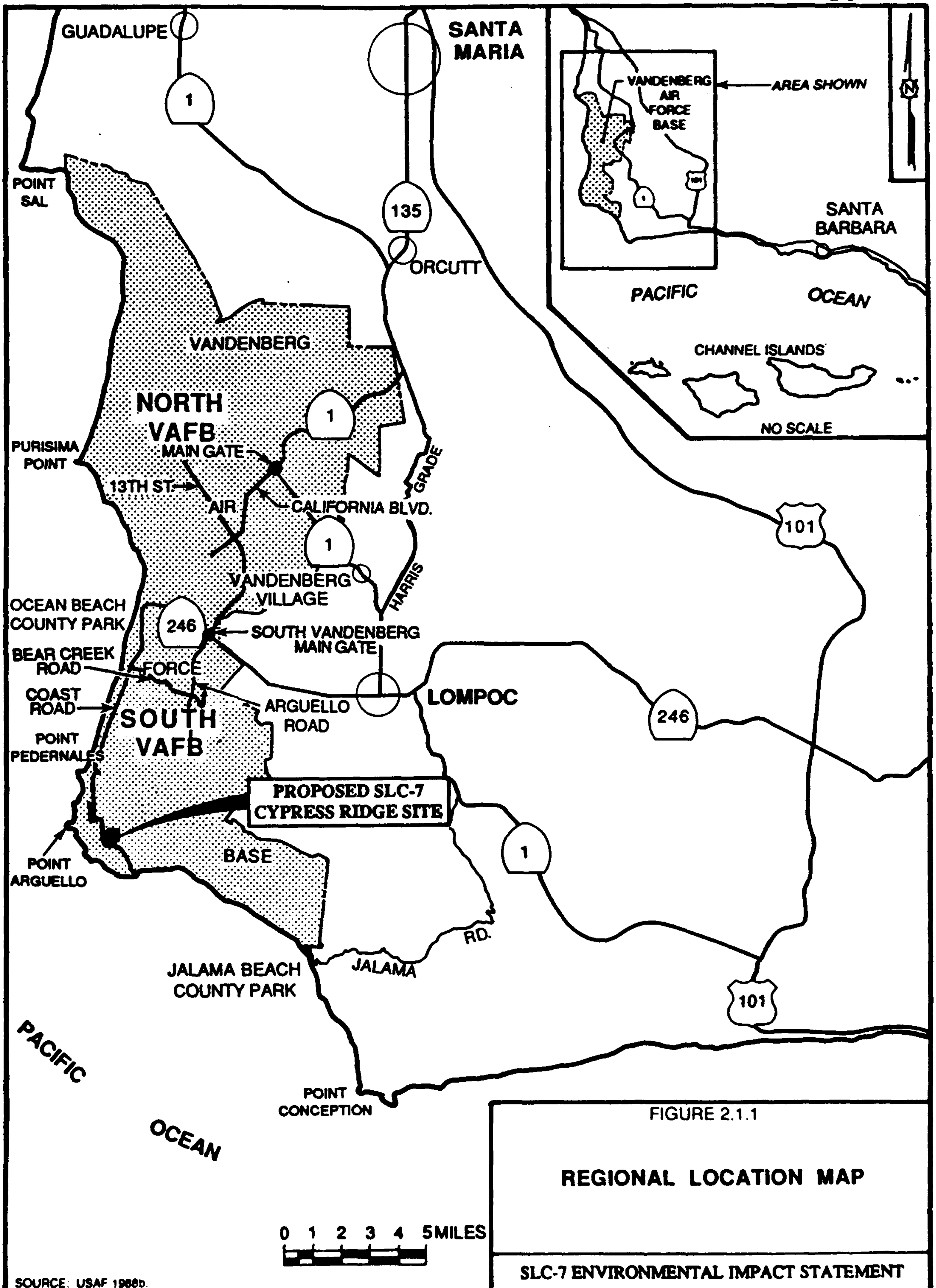


FIGURE 2.1.1

REGIONAL LOCATION MAP

SLC-7 ENVIRONMENTAL IMPACT STATEMENT

SOURCE: USAF 1988b.

REVISED: 10/6/88

placed into mothball status. Since SLC-6 is not being utilized or reserved for future missions and because it contains many of the elements necessary for the launch of the Titan IV/Centaur, it was considered suitable for evaluation as an alternative to the proposed action.

The proposed project site is near Point Arguello at a location known as Cypress Ridge, shown in Figure 2.1.2 (Proposed Cypress Ridge Site and Alternatives). The 120-acre site is located on a southerly sloping terrace with elevations ranging from 200 to 600 feet above sea level. The site boundary, shown in Figure 2.1.3 (Proposed Cypress Ridge Site), has been delineated based upon the primary area of disturbance that would occur from one or more activities associated with construction or operation of the proposed action. The three preferred alternatives are shown in Figure 2.1.2 and described in Section 2.2, Alternatives to the Proposed Action.

Access to the launch complex would be primarily through the VAFB South Gate entrance via State Highway 246, then over USAF-controlled secondary roadways (Arguello Road and Bear Creek Road) to Coast Road, and then to the proposed site. These roads are shown in Figure 2.1.1.

2.1.3 PROJECT ELEMENTS

Project elements necessary for the proposed Titan IV/Centaur program would include SLC-7 onsite facilities, adjacent offsite facilities (such as utilities), other existing VAFB facilities (such as the Launch Control Center), and the Titan IV/Centaur vehicle itself. A tentative site plan for the proposed project is shown in Figure 2.1.4 (Preliminary Launch Complex Plan). This preliminary layout is based upon current concepts for the facility, which may be revised when detailed engineering studies are completed. As shown in Figure 2.1.4, the launch complex would be an area about 2,300 feet long, 1,000 feet wide, and about 53 acres in size. This site area would be surrounded by security fencing and accessed through a single location. A schematic diagram of the facilities is shown in Figure 2.1.5 (Conceptual Rendering, SLC-7 Site and Facilities).

The launch complex provides the ability to assemble, check out, and launch the Titan IV/Centaur or, in the case of a launch abort, to safely shut down the vehicle systems. Design includes launch control and check-out equipment. Following a launch, post-launch refurbishment and preparation for the next launch would begin according to specific mission requirements. Commodity storage capacity for propellants (fuels, oxidizers, etc.) is planned to meet a timely turnaround requirement for successive launches.

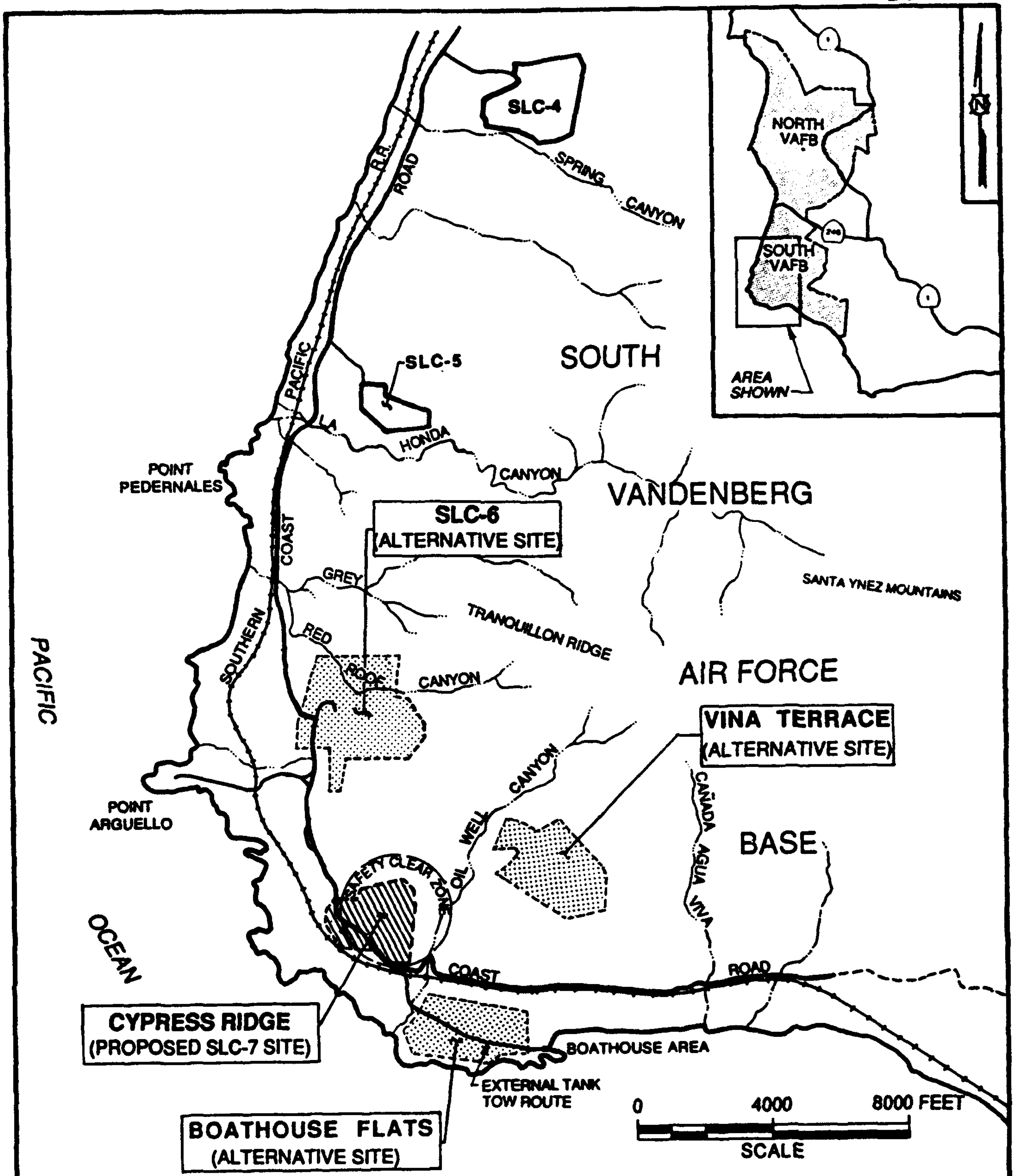


FIGURE 2.1.2

PROPOSED CYPRESS RIDGE SITE AND ALTERNATIVES

SLC-7 ENVIRONMENTAL IMPACT STATEMENT

SOURCE: ENVIRONMENTAL SOLUTIONS, INC. - 1989g.

REVISED 2/21/89

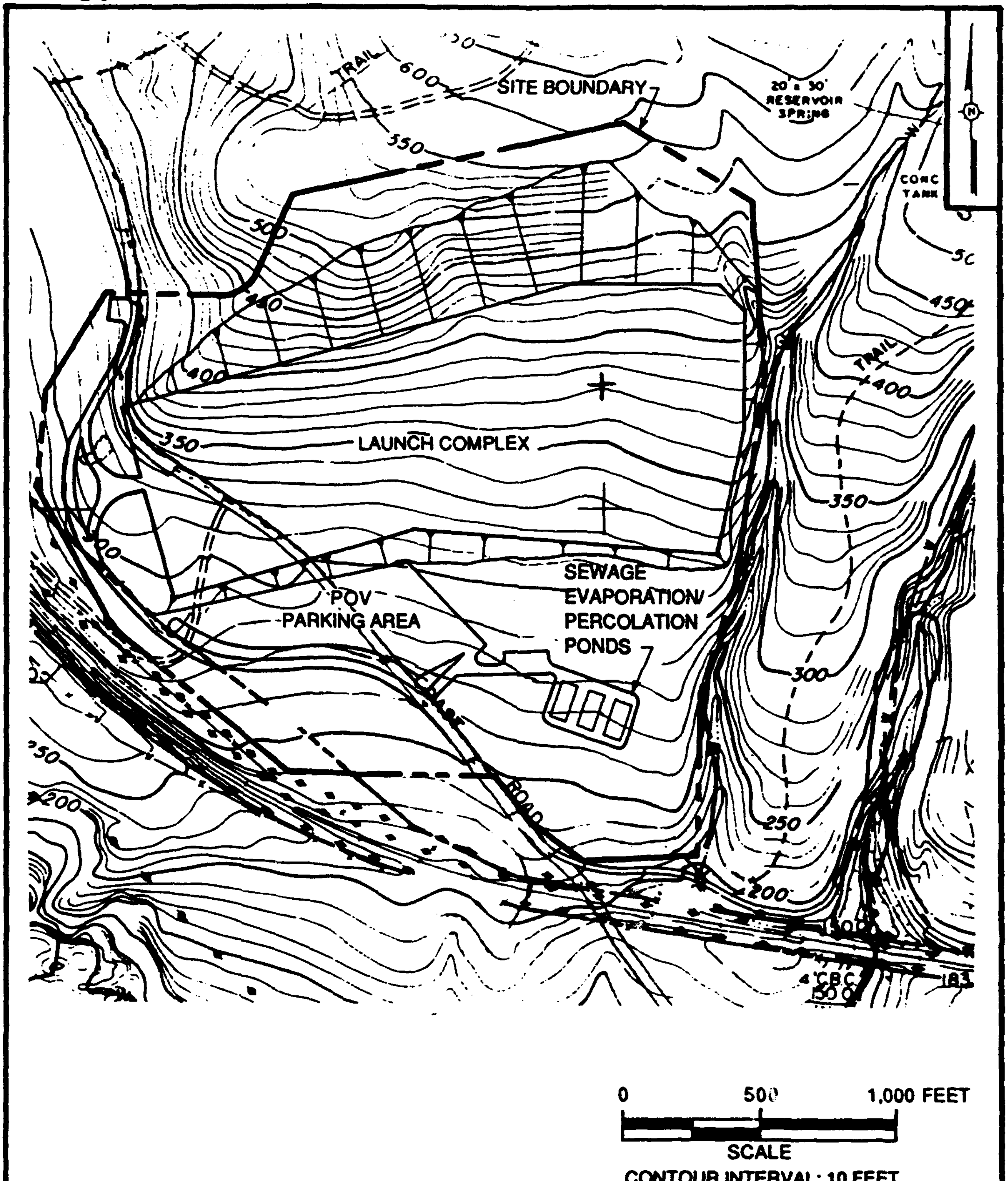


FIGURE 2.1.3

PROPOSED CYPRESS RIDGE SITE

SLC-7 ENVIRONMENTAL IMPACT STATEMENT

NOTE: ACTUAL PLACEMENT OF FACILITIES SUBJECT TO USAF CRITERIA AND FINAL DESIGN CONSIDERATIONS.

TOPO. MAPPING DONE BY INTERNATIONAL MAPPING CORPORATION, LOS ANGELES, CALIF.

REVISED 11/1/88

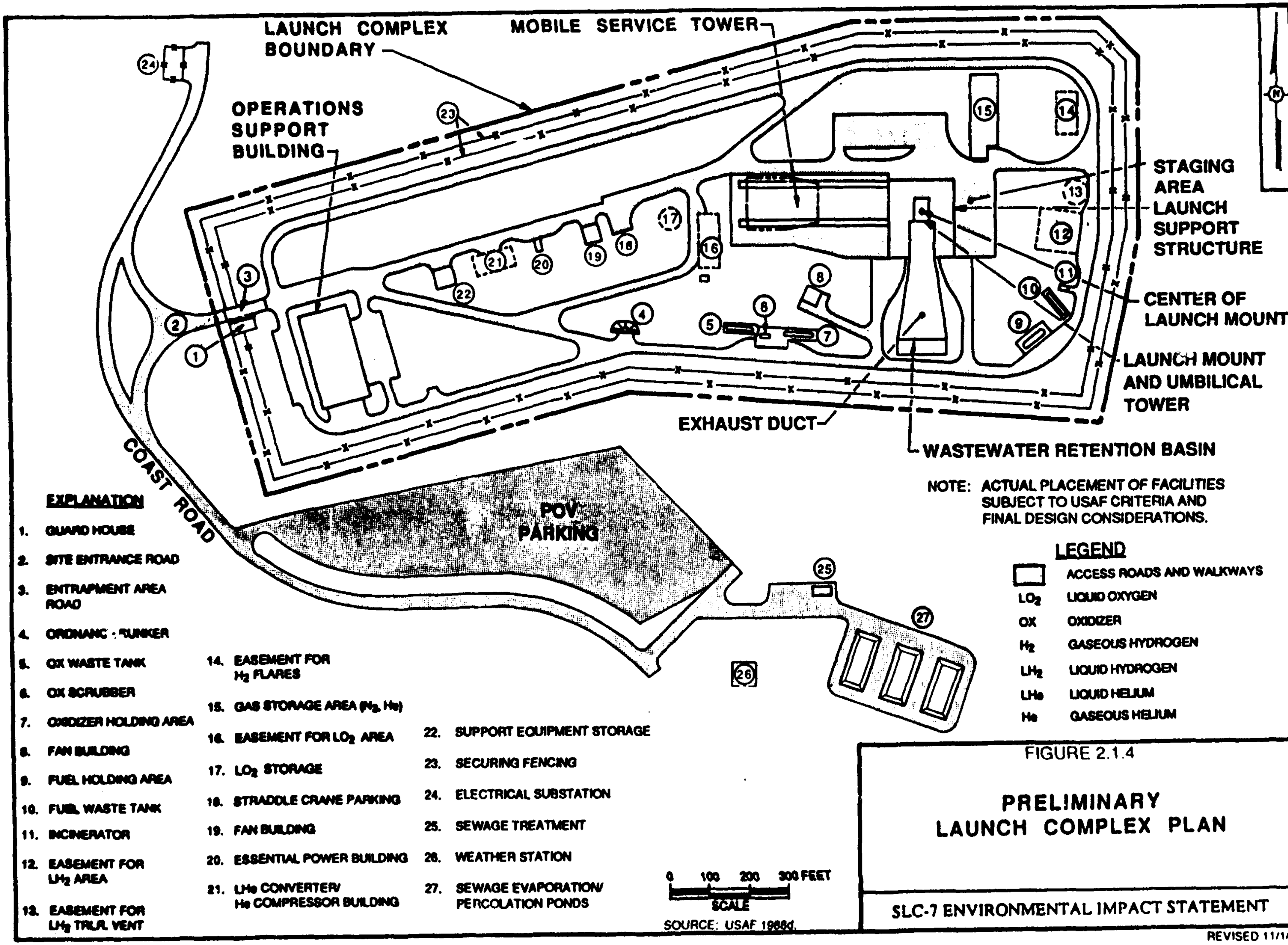


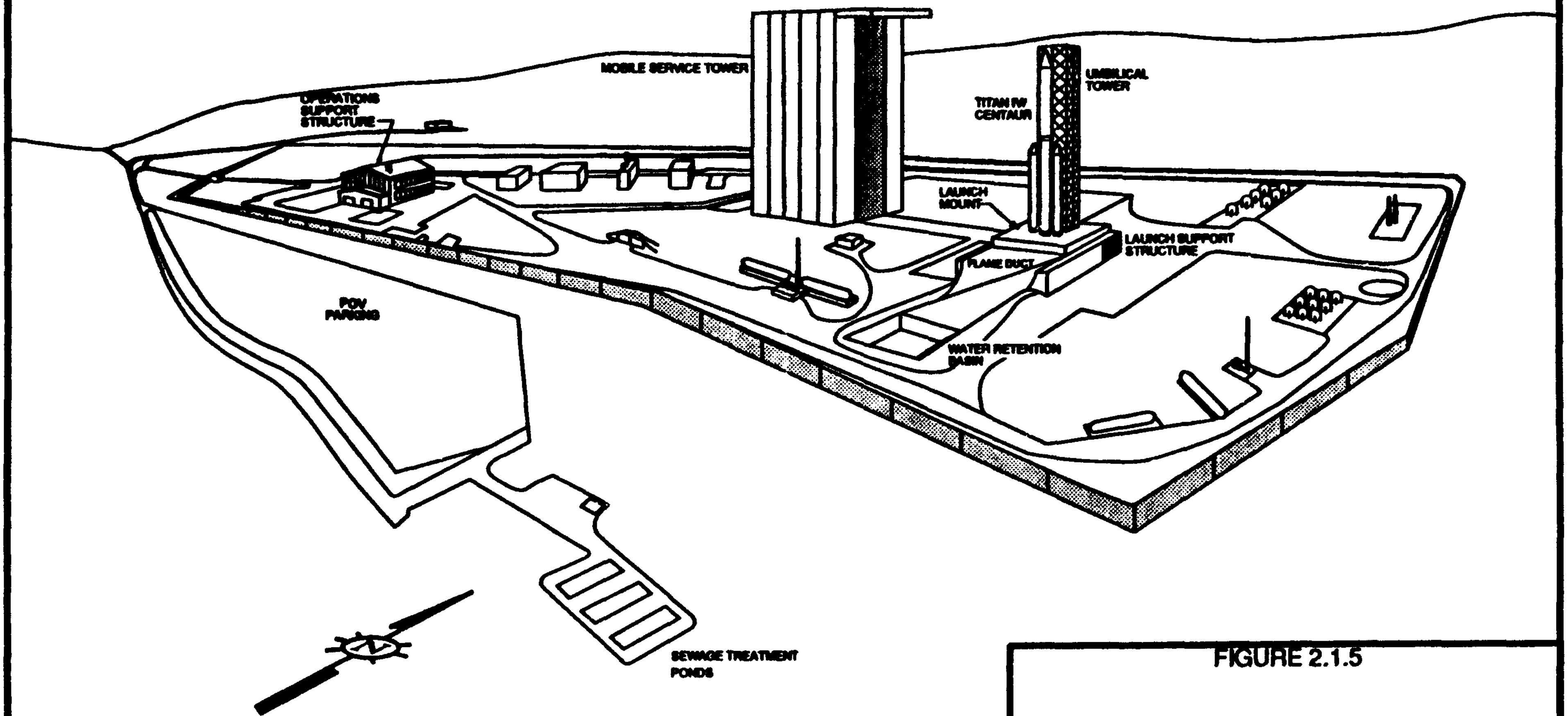
FIGURE 2.1.4

PRELIMINARY LAUNCH COMPLEX PLAN

SLC-7 ENVIRONMENTAL IMPACT STATEMENT

REVISED 11/1/88

87-271/CoDr/2.1.5



NOTE: ACTUAL PLACEMENT OF FACILITIES SUBJECT TO USAF CRITERIA AND FINAL DESIGN CONSIDERATIONS.

SOURCE: USAF 1988d.

FIGURE 2.1.5

CONCEPTUAL DRAWING CYPRESS RIDGE SITE AND FACILITIES

SLC-7 ENVIRONMENTAL IMPACT STATEMENT

REVISED 4/5/88

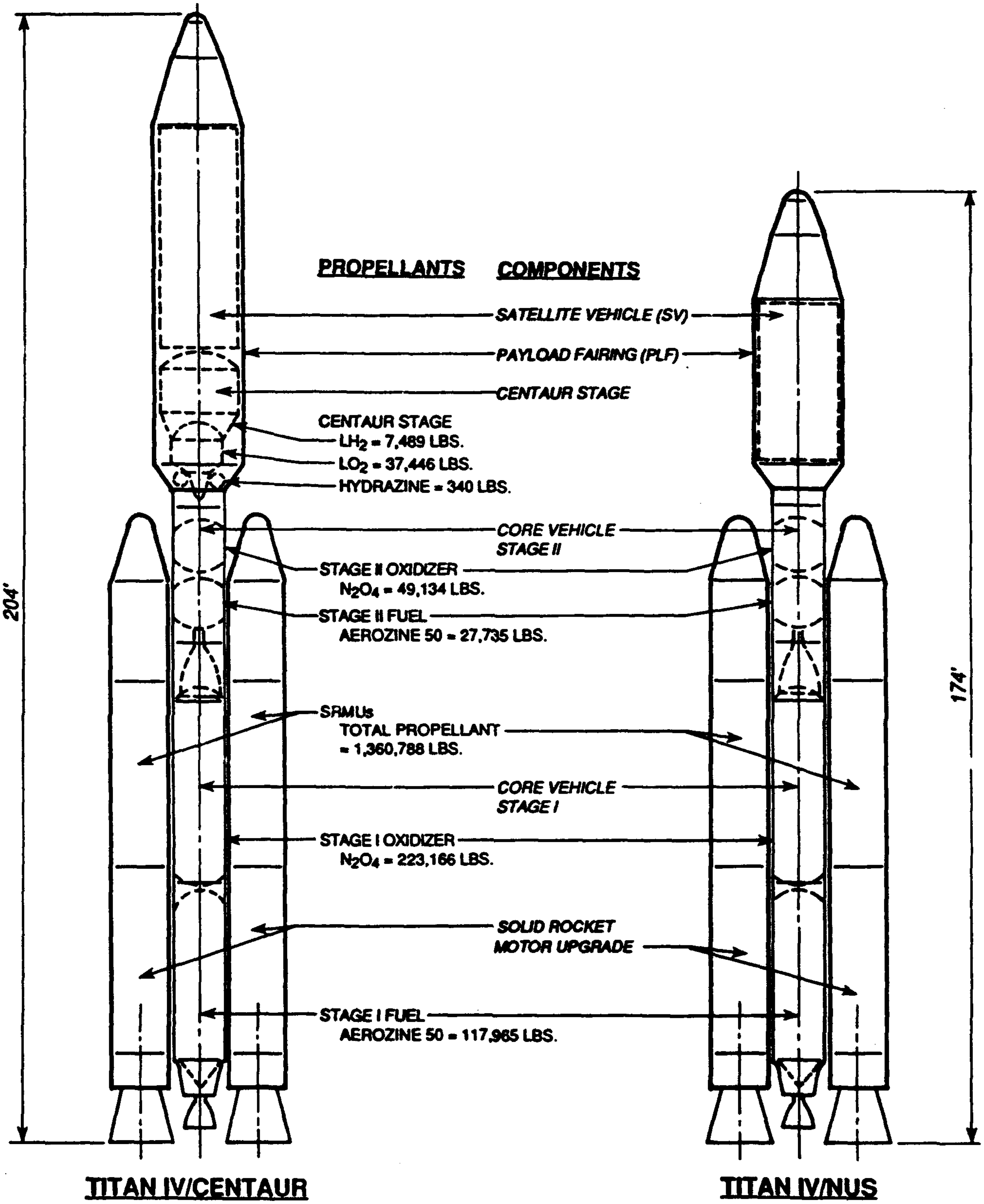
Ancillary facilities adjacent to the launch complex would include a parking area for privately-owned vehicles (POVs), a weather station, a sanitary sewage treatment plant, evaporation/percolation ponds, an electrical substation, and utility corridors. Elements of the launch complex, including the Titan IV/Centaur vehicle, primary support structures, and ancillary structures, are described below.

2.1.3.1 Titan IV/Centaur Space Launch Vehicle

The Titan IV/Centaur is the latest development in the continuing Titan program. This launch vehicle will provide high energy, earth orbit delivery of satellites weighing up to 10,000 pounds and have a thrust capability of 3.2 million pounds. Components of the Titan IV/Centaur include two upgraded Solid Rocket Motors (SRMUs), Core Vehicle (stages I and II), Centaur Stage, Payload Fairing (PLF), and Satellite Vehicle (SV) (see Figure 2.1.6, Titan IV Vehicle Configurations). Another configuration that could be supported from the proposed launch complex is the Titan IV/NUS launch vehicle (see Figure 2.1.6).

Two solid rocket motor upgrades (SRMUs) power the initial liftoff and together contain a total of approximately 1.4 million pounds of solid rocket propellant, consisting of ammonium perchlorate and an aluminum binder fuel. The SRMUs fire for approximately 2.5 minutes, at which time they separate from the core vehicle. The expended SRMUs fall into the ocean and are not recovered. The core vehicle consists of two stages and uses liquid propellants consisting of a fuel, Aerozine 50 (50 percent hydrazine and 50 percent unsymmetrical dimethyl hydrazine [UDMH]), and an oxidizer, nitrogen tetroxide (N_2O_4). Stage I burns for approximately three minutes, at which time it separates from Stage II. Stage II then burns for approximately four minutes, at which time it separates from the remainder of the space vehicle. These stages also fall into the ocean and are not recovered. The Centaur is the last stage of the space launch vehicle and is used to boost the satellite into high energy orbit with one to three burns, depending on the desired orbit altitude for the satellite. After the final burn, the Centaur separates from the satellite and remains in orbit.

The Payload Fairing (PLF), which houses the satellite, is a 16.7-foot diameter, up to 84-foot long cylindrical encasement. The PLF consists of three sections called "trisectors" which, when joined, form the cylindrical satellite housing. The PLF is jettisoned during Stage I burn, falls into the ocean, and is not recovered.



LEGEND

LH_2	-	LIQUID HYDROGEN
LO_2	-	LIQUID OXYGEN
N_2O_4	-	NITROGEN TETROXIDE
AEROZINE	-	50% HYDRAZINE, 50% UDMH

FIGURE 2.1.6

TITAN IV
VEHICLE CONFIGURATIONS

SLC-7 ENVIRONMENTAL IMPACT STATEMENT

SOURCE USAF 1988d

2.1.3.2 Primary Support Structures

Various support structures and equipment are necessary to process and launch the Titan IV/Centaur. These consist of specific structures at the proposed launch complex, as well as facilities and utilities located elsewhere on VAFB. The primary support structures described below would be located within the launch complex area (see Figure 2.1.5).

Launch Support Structure

The Launch Support Structure (LSS) is a partially underground concrete structure, which is topped by the Titan IV/Centaur launch deck. The LSS provides the staging area and necessary facilities to support launch-related activities, including assembly of the Titan IV/Centaur vehicle components, systems check-out, and launch.

The LSS also contains an open channel, known as the exhaust duct, that directs the exhaust flame from the two SRMUs during ignition of the launch vehicle for safe dispersal of the exhaust plume away from the launch deck and complex. The exhaust duct also conveys wastewater runoff from water sprayed for deluge and fire suppression during launch to a retention basin. The LSS is designed to withstand the effects of a launch. This is accomplished by designing the structure to withstand launch-induced overpressure and by providing flame shields, protective coatings, and cooling water to reduce the effect to the structure from heat generated by the SRMUs.

Launch Mount and Umbilical Tower

The Launch Mount (LM) and Umbilical Tower (UT) are situated over the LSS. The LM provides structural support for the launch vehicle. The UT provides electrical, propellant, and air conditioning systems to support the launch vehicle while it is on the LM. The UT also provides personnel access to various levels of the space launch vehicle during final launch preparation.

Mobile Service Tower

The Mobile Service Tower (MST) is a structure approximately 300 feet high, housing a 220- to 240-ton crane for vehicle assembly and a clean enclosure for satellite vehicle integration and testing. The MST has internal platforms that provide access to the launch vehicle. The MST is

located on a track and is moved into place surrounding the LM. Launch vehicle components arrive at the launch pad deck on transporters and are positioned under the MST crane to be hoisted into a vertical position on the LM.

Operations Support Building

The Operations Support Building (OSB) is a two-story, 56,000 square foot structure located in the westerly portion of the complex, with facilities necessary for daily engineering and operations support and coordination of the proposed SLC-7 project. Included within the OSB are: briefing/training room, technical operations area, offices, data library, communications equipment, complex management center, maintenance and machine shops, storage, toilets, lockers, showers, lunchroom, and other necessary personnel support areas.

2.1.3.3 Ancillary Project Elements

Ancillary project elements necessary for the launch of the Titan IV/Centaur include roads, buildings, storage facilities, and utilities, as depicted in Figure 2.1.4. Roads and utilities would link the SLC-7 complex with existing systems at other locations within VAFB.

Roads and Parking

New paved road construction for access to the launch complex and other offsite facilities would include a realignment of a portion of the existing Space Shuttle External Tank Tow Route (Coast Road) and provision for other roads to give access to the site, the electrical substation, and the sanitary sewage treatment plant. Existing roads to the north and south of the proposed Cypress Ridge site would be repaired, as necessary, and utilized as security patrol roads. New roadways within the launch complex area would include the perimeter road, the entrapment area road, and other access roads linking project elements and associated parking. An approximate 5-acre POV parking area would be located adjacent to the launch complex within the site boundary (see Figure 2.1.4).

Support Equipment Buildings

Support equipment buildings would be provided within the fenced area and include a paint and lubricant storage building, an ordnance bunker, a storage facility, an essential power building, and other structures, as necessary.

Propellant and Gas Holding Areas

Propellant and gas holding areas include a gas storage area, Titan IV core vehicle fuel and oxidizer holding areas, payload fuel and oxidizer holding pads, and cryogenic holding areas. The various holding areas also would include pollution control devices, as appropriate. Storage facilities and approximate commodity quantities are as follows:

- The Gas Storage Area would include storage and handling facilities for approximately 3,000 cubic feet of gaseous helium, at 6,000 psig, and 5,000 cubic feet of gaseous nitrogen, also at 6,000 psig. Gaseous nitrogen is used in the pressure testing of the Titan IV/Centaur fuel and oxidizer storage tanks. It is also used as a purge gas for the hypergolic propellant lines after propellant transfer.

- The Titan Core Vehicle Oxidizer (N_2O_4) Storage Area would consist of a 40,000-gallon ready storage vessel (RSV), pump, vapor control system, propellant loading unit, and a 40,000-gallon waste vessel. Separate containment areas are provided for the storage and waste vessels. These areas are sized to contain about 60,000 gallons each.

- The Titan Booster Vehicle Fuel (Aerozine 50) Storage Area would consist of a 40,000-gallon RSV, pump, vapor control system, propellant loading unit, and 40,000-gallon waste vessel. In addition, an automatic deluge water system would dilute any spill, thereby reducing the chance of vapors escaping to the atmosphere. There would be two separate containment areas for the RSV and waste vessel. Each containment area would have a volume of approximately 175,000 gallons and is designed to hold the contents of each vessel plus deluge water at a ratio of 1:3. In addition, there is a 1,500-gallon sump within the waste tank containment area. The sump functions as a drain from each area and is designed for one-way flow so that fluid which enters cannot flow out.

- The Payload Fuel and Oxidizer Holding Pads would be used for short-term storage until payload fuel and oxidizer could be transferred to the satellite vehicle.

- The Cryogenic Holding Areas would include storage for about 15,000 gallons of liquid oxygen (LO_2), about 40,000 gallons of liquid hydrogen (LH_2), and about 4,000 gallons of liquid helium (LHe). The liquid hydrogen area would use a flare stack to burn excess vapor, and the liquid oxygen area would use a dump pond to evaporate liquid oxygen spills. Liquid helium spills would be contained by a wall surrounding the liquid helium tank. Liquid oxygen and hydrogen are used as propellant for the Centaur stage of the Titan IV. Liquid helium is used for Titan IV/Centaur processing and engine conditioning and for payload fairing processing.

Utilities/Utility Corridors

Utilities necessary for operation of the proposed SLC-7 project would include a series of onsite systems, including water (potable, wastewater, and deluge), sanitary sewer, propane gas, communications, and electrical. New utility lines would connect the launch complex systems to existing VAFB facilities, as shown in Figure 2.1.7 (Preliminary Utility Corridors and Construction Areas, Proposed Alignment). An alternative utility corridor alignment is shown in Figure 2.1.8 (Preliminary Utility Corridors and Construction Areas, Alternate Alignment).

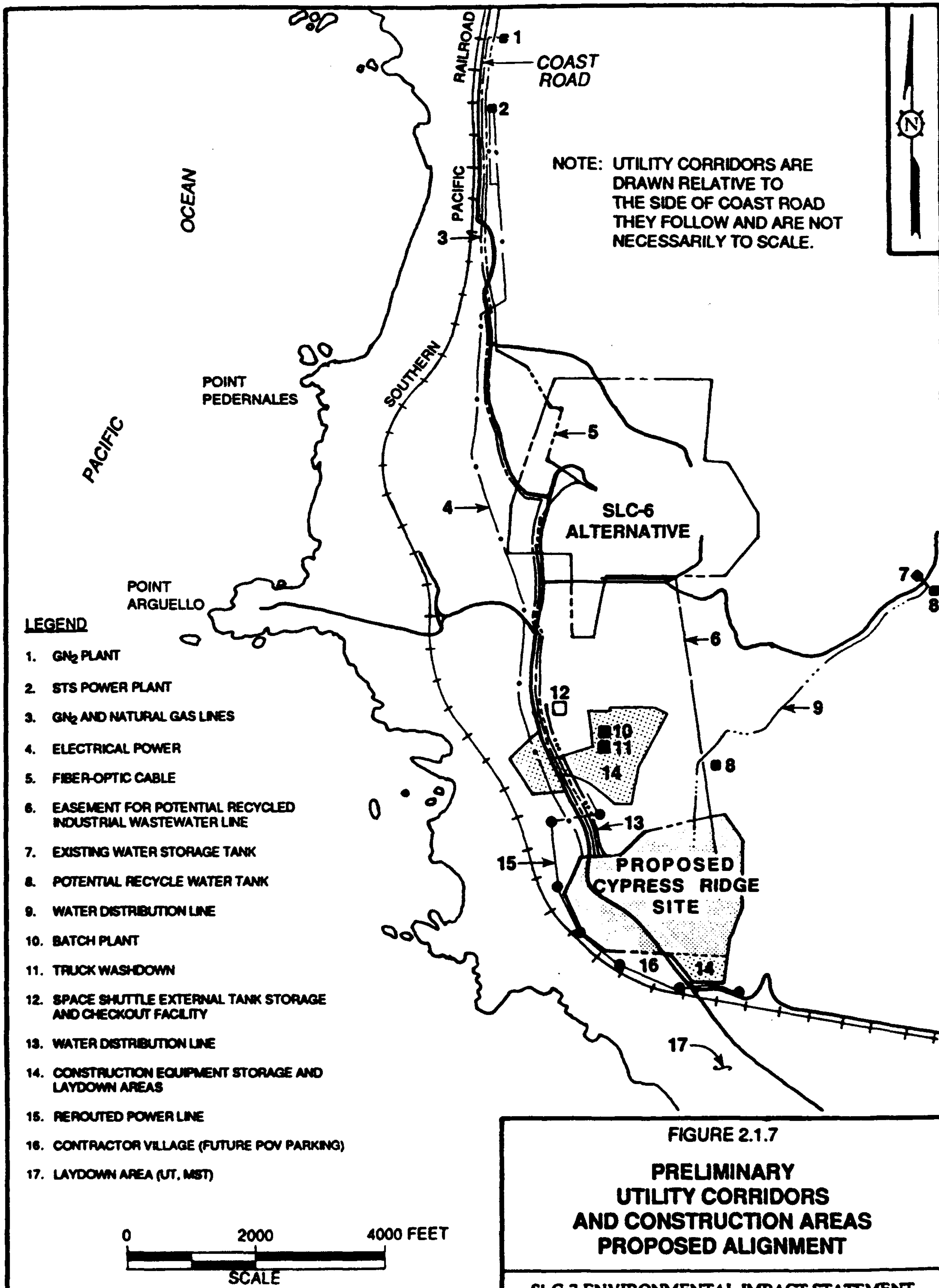
Electrical

Electrical demand for the launch complex is estimated to be approximately 6,000 kVA. This demand would be met by a new electrical substation located northwest of the launch complex. Power to the substation would be provided by dual 12.47 kV overhead transmission lines, one from a commercial power source, and one a new line from the STS Power Plant. The new line would be used as a standby power source in the event that commercial power is lost. It would be constructed within either the proposed or alternative corridor, shown in Figures 2.1.7 and 2.1.8 respectively. A switching mechanism in the substation would allow either commercial or standby power to be fed to the SLC-7 secondary power distribution system. During launch processing, the 12.47 kV line from the STS Power Plant would be used, with commercial power providing a standby power source. For launch, commercial power would be used, with the STS Power Plant providing backup.

An essential power generator has also been included in the proposed SLC-7 concept. This would be a 480 V, three-phase generator capable of supplying a minimum of 500 kVA. In case of a power failure during launch operations (i.e., in the event of failure of both the STS Power Plant and commercial power supply), the essential power generator would supply power for the launch site security system and for essential launch shutdown and safety functions.

Propane

Propane gas would be utilized for heating and cooling and as auxiliary fuel for flare stack pilot flames, if required. Appropriate storage vessels and distribution lines would be constructed in support of these needs. In addition, there would be a utility corridor easement in the event of natural gas being provided to the site at some future date.



SOURCE: USAF 1988f.

FIGURE 2.1.7

PRELIMINARY UTILITY CORRIDORS AND CONSTRUCTION AREAS PROPOSED ALIGNMENT

SLC-7 ENVIRONMENTAL IMPACT STATEMENT

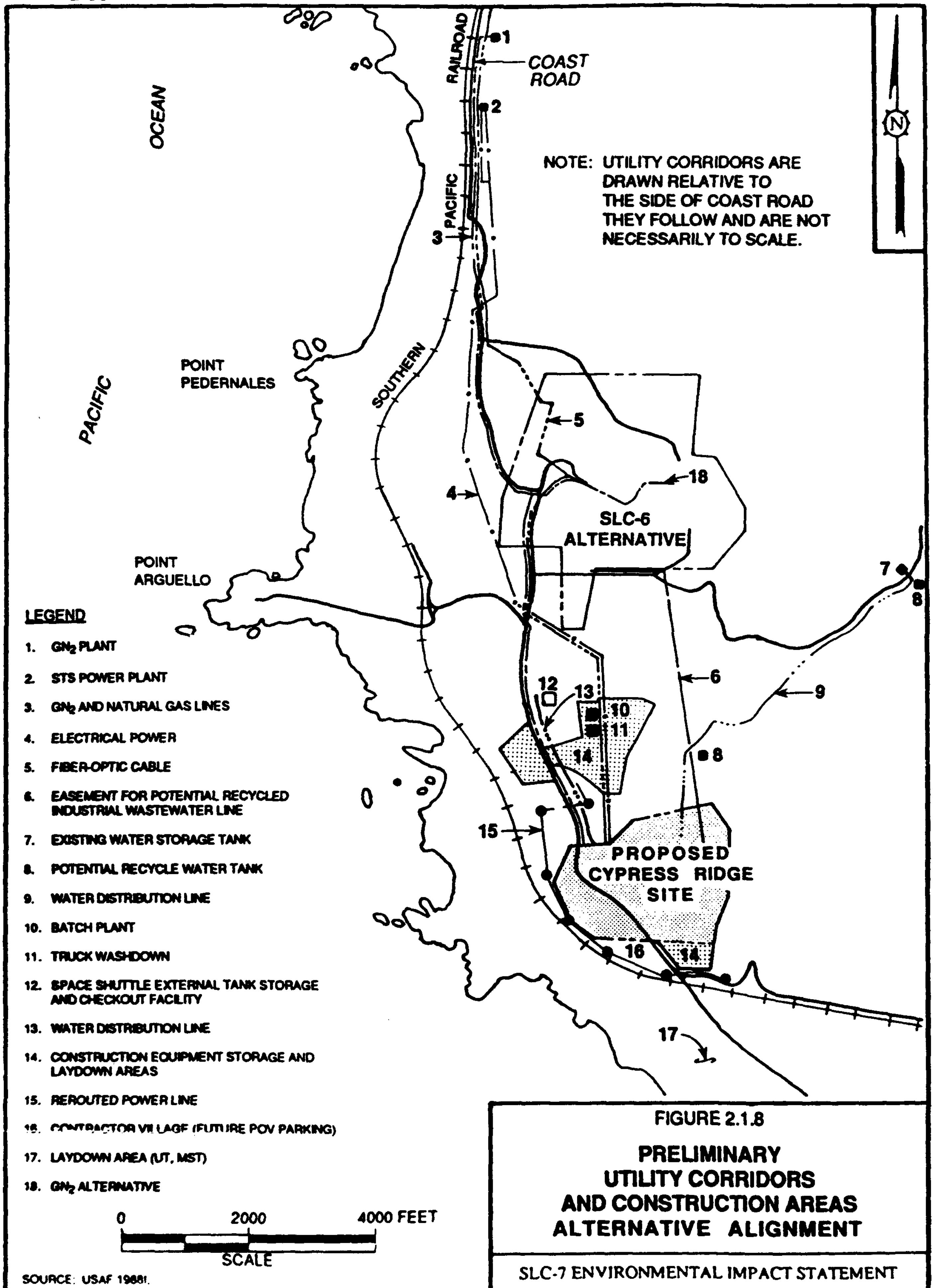


FIGURE 2.1.8

PRELIMINARY UTILITY CORRIDORS AND CONSTRUCTION AREAS ALTERNATIVE ALIGNMENT

SLC-7 ENVIRONMENTAL IMPACT STATEMENT

Potable Water

A water distribution system would be developed to supply SLC-7 with water for fire suppression, launch deluge, washdown, and domestic uses. For each launch of the Titan IV/Centaur, approximately 146,000 gallons of water would be required. Of this amount, 80,000 gallons would be used for pre-launch check-out, 26,000 gallons for launch deluge, and 40,000 gallons for post-launch washdown. Of the 146,000 gallons, 20,000 would evaporate during launch and form a ground cloud. Based on fire suppression water requirements, a minimum of 800,000 gallons would be stored in reserve. This storage and distribution would be achieved through a SLC-7 water system, interconnected with the existing VAFB water supply system. Lines would be extended from the Space Shuttle External Tank Processing and Storage Facility and an existing tank located north and east of the proposed Cypress Ridge site. In addition, an easement for a second water storage tank would be reserved (see Figure 2.1.7).

Domestic Wastewater Treatment Facility

A sanitary sewage treatment facility would be located outside the fenced launch complex. The facility would be designed to accommodate domestic sewage discharge from all SLC-7 facilities. Treated effluent would be disposed of in new evaporation/percolation ponds, as shown in Figure 2.1.3.

Industrial Wastewater Treatment and Disposal

Disposal of wastewater from launch deluge and washdown would be accomplished by use of existing VAFB treatment and disposal facilities. Transfer of wastewater would be by tank truck from the project site, directly to the SLC-6 evaporation ponds or to the treatment plant at SLC-6, then to the SLC-6 evaporation ponds. An easement for a future wastewater pipeline and tank between the proposed Cypress Ridge site and SLC-6 has been provided, as shown in Figure 2.1.7, in the event transportation by tank truck should become economically unfeasible. A UV/ozone wastewater treatment system would be used to treat launch deluge and washdown water, if available at VAFB.

Communications

Communications would be provided for voice (intercom and telephone), closed circuit TV, computer data, public address, and area warning systems. Remote TV and film cameras would be positioned at offsite locations surrounding the launch complex. Communications would be via buried fiber-optics cable, scheduled for completion prior to the initial launch. The existing cable will extend from Building 8510 on North VAFB to SLC-6 on South VAFB. The cable would be

extended to the Cypress Ridge site, as part of the proposed action, within either the proposed or alternative corridor, as shown in Figures 2.1.7 and 2.1.8 respectively.

2.1.3.4 Other VAFB Facilities

There are facilities and systems at VAFB that serve as common support for the existing array of launch complexes. The SLC-7 Titan IV/Centaur project would utilize a number of these facilities during various launch preparation and operations activities. For example, facilities are in place for the receipt, testing, inspection, and assembly of vehicle components. Building 8510 on North VAFB would be used as a Launch Control Center (LCC) during launch operations to communicate with SLC-7 and the Titan IV/Centaur vehicle. Other existing systems are in place for transportation and utilities (power, water, gas, and communications). Existing industrial wastewater storage and treatment facilities are available at SLC-6. The specific functions and locations of other existing facilities proposed to be utilized are presented below and shown in Figure 2.1.9 (Titan Program, Existing VAFB Facilities).

Booster Vehicle Receipt and Processing - Building 8401

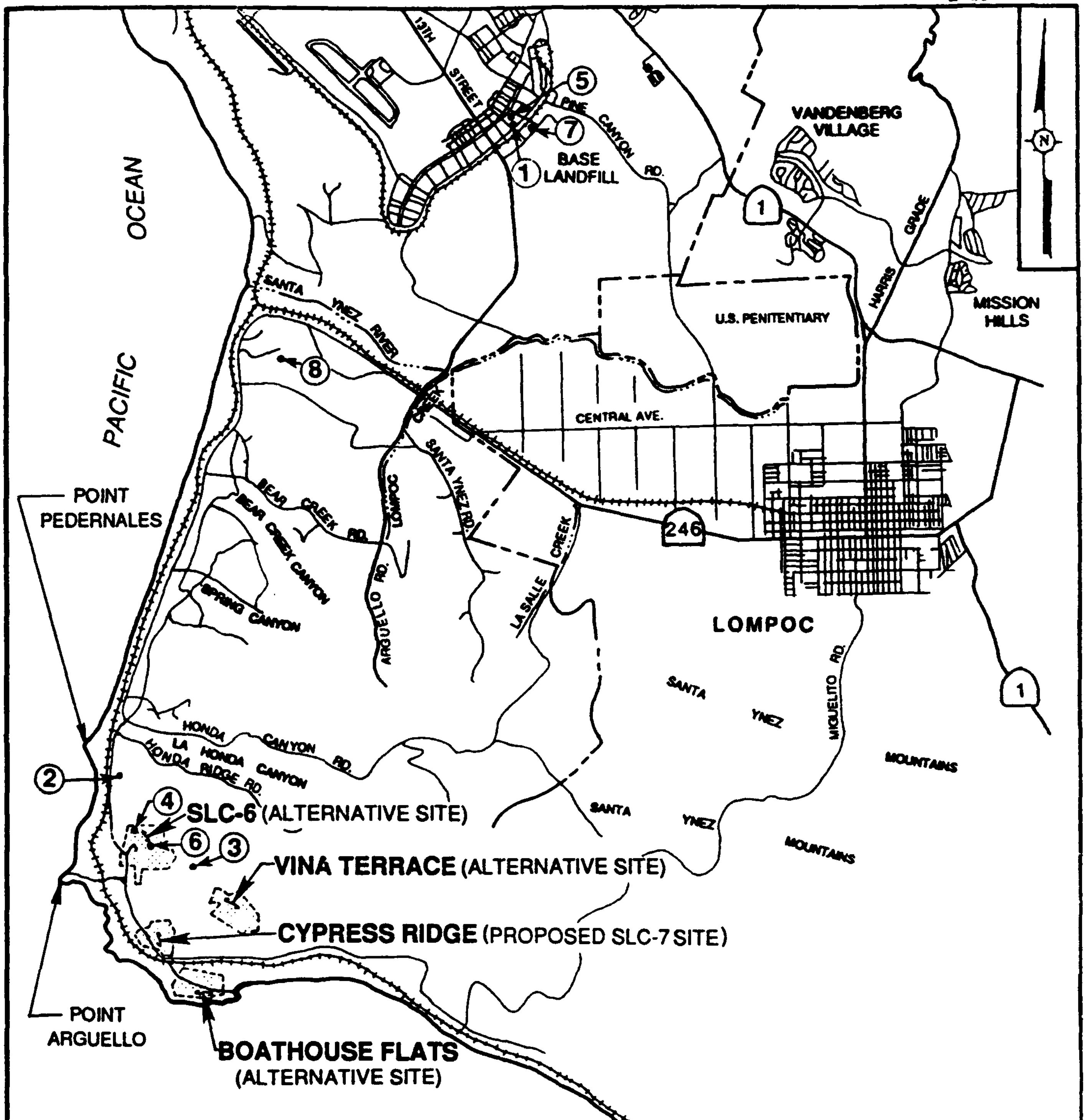
The Booster Vehicle Receipt and Processing Building would be used for final assembly of the Titan IV core vehicle. The facility, located in Building 8401, is designed to process five Titan IV and three Titan II vehicles per year. The Titan programs at SLC-4 and SLC-7 would share this facility.

SRMU Receipt, Inspection, and Storage - Building 398

The SRMU segments would be received at Building 398 at SLC-6, where they would undergo inspection, subassembly, check-out, and weighing. This building has been modified for use with the Space Shuttle solid rocket boosters. It would provide storage for two sets of SRMUs.

Payload Fairing Receipt and Processing - Building 8337

The Payload Fairing Receipt and Processing facility is located in Building 8337 and would be used to prepare the payload fairings for assembly onto Titan IV vehicles for launches at SLC-4E and SLC-7. Titan II payload fairings will also be processed here for use at SLC-4W. This building contains two spray paint booths for applying coatings to the payload fairings.



<u>FACILITY BUILDING DESCRIPTIONS</u>

1. BOOSTER VEHICLE RECEIPT AND PROCESSING - #8401
2. STS POWER PLANT
3. WATER STORAGE
4. SRMU RECEIPT, INSPECTION AND STORAGE - #398
5. PAYLOAD FAIRING RECEIPT AND PROCESSING - #8337
6. SLC-6 WASTEWATER TREATMENT PLANT - SLC-6 SITE
7. LAUNCH CONTROL CENTER - #8510
8. HYPERGOLIC PROPELLANT STOCKPILE FACILITIES #975 AND #977

0 2 4 MILES

SCALE

FIGURE 2.1.9

TITAN PROGRAM
EXISTING VAFB FACILITIES

Payload Receipt and Processing (Existing VAFB Facility)

It is expected that payload receipt and processing would be accomplished at existing VAFB facilities that currently support Titan IV programs at SLC-4.

Launch Control Center - Building 8510

The proposed site for the LCC is in Building 8510, located on North VAFB. The LCC would be used to support integration, test, and launch operations by connection with the launch complex via fiber-optic cable.

Hypergolic Propellant Stockpile Facilities - Buildings 975 and 977

The hypergolic fuel and oxidizer would be stockpiled in two different locations off of Mesa Road. Each facility contains six 28,000-gallon tanks and the appropriate waste containment facilities. Prior to launch, this propellant would be transferred via truck to Ready Storage Vessels at the launch complex. Both SLC-4 and SLC-7 would use these facilities for the Titan II and Titan IV programs.

2.1.3.5 Safety Systems

A mission-specific safety plan would be developed by the USAF to ensure that each launch operation is in compliance with applicable regulations, as specified in numerous compliance documents, including the following:

- AFR 800-16 - Acquisition Management, USAF Safety Programs (including AFSC Supplement 1, AFR 800.16)
- WSMCR 127-1 - Range Safety Regulation
- 1 STRADR 127-200 - Missile Mishap Prevention
- AFR 127-100 - Explosive Safety Standard
- AFM 88 Series - Design Criteria and Standards for Air Force Construction
- EM-385-1-1 - Safety and Health requirements for all Corps of Engineers activities and operations.
- 1STRAD/SEWE - Explosive Site Safety Plan

- Hazard Analysis, to be developed by launch support contractors.
- AFOSH - U.S. Air Force Occupational Safety and Health

The Safety Plan also recognizes the following codes and regulations:

- NFPA/NFC - National Fire Protection Association, National Fire Codes
- ANSI - American National Standards Institute
- OSHA - Occupational Safety & Health Administration

Fire Protection System

Fire detection, alarm, and fire suppression systems would be provided for the fuel holding areas, support facilities buildings, LSS, ordnance bunker, MST, and other structures. The OSB and LSS would have Halon fire extinguishing systems placed in selected areas to protect computer and electrical equipment. Ultraviolet flame detectors and infrared detectors used in the fuel holding area would activate both the area deluge system and alarms at the OSB and VAFB Fire Department. For oxidizer holding areas, a fire detection and alarm system would be provided. However, an area deluge system would not be included, due to the reactive nature of N_2O_4 with water.

Cathodic Protection

An active cathodic protection system would be provided in accordance with AFM 88-45. The equipment to be protected includes the underground piping and some of the aboveground storage tanks. The cathodic protection system would include rectifiers, groundbeds, test stations, interface bonds, and sacrificial anodes.

Security

Security requirements for the SLC-7 project are an integral component of project safety. Security measures would be incorporated within the project design and through operational procedures. Elements of site security include a perimeter security fence, clear zone, entrapment area road, security lighting, security standby power, intrusion detection system, and security patrol roads. Procedures for security include use of entry controllers, alarm monitors, alarm/security response teams, and appropriate weapons, radios, and vehicles in accordance with USAF regulations.

Safety

Safety procedures for the area surrounding the launch site are established. Prior to launch, the coastal waters and surrounding areas are patrolled, and train movement through VAFB is monitored. Jalama Beach County Park is selectively closed to public access prior to space launches over this area. Before launch procedures begin, the USAF encourages that only essential personnel remain on offshore oil rigs in the path of the space vehicle over-flight.

Emergency egress for personnel would be provided in four direction. As planned, provisions for personnel egress would consist of 4-foot wide gates which could be opened from the inside in case of emergency. There also would be a gate for emergency vehicular egress.

Also, two emergency egress tunnels would be linked to the launch support structure. These tunnels would provide ventilation to the LSS and also allow a means of evacuation during catastrophic events. Each tunnel would be at least 855 feet long, seven feet six inches high, and 44 inches wide. The tunnels would have doors at each end capable of being opened from the inside.

Quantity-Distance Criteria

Quantity-Distance Criteria (QD) are used to establish safe distances from launch complexes and associated support facilities to nonrelated facilities and roadways. These regulations are established by DOD and USAF Explosives Safety Standards. The criteria utilize the TNT explosive equivalent of propellants onboard a fueled launch vehicle, or stored components or propellants, to determine safe distances from space launch operations or processing and holding areas. Safety clear zones determined by these criteria are shown for existing space launch complexes and the proposed SLC-7 in Figure 2.1.2. For the Titan IV/Centaur, this TNT equivalent amount is 72,000 pounds for a fully loaded vehicle on the pad prior to launch, which means that the minimum allowable distance of an inhabited building to the propellant-loaded launch vehicle is 1,700 feet, and the closest allowable distance for an uncontrollable public thoroughfare is 1,000 feet. The proposed action has been designed to meet these criteria.

2.1.4 PROJECT CONSTRUCTION ACTIVITIES

It is anticipated that construction of the SLC-7 project would be accomplished over a period of approximately four years, beginning in 1990, as shown in Figure 2.1.10 (Preliminary Construction Schedule and Personnel Requirements for the Proposed Action). There is the potential for this schedule to extend to five years, in which case the activation/operations phase would occur in Year 6.

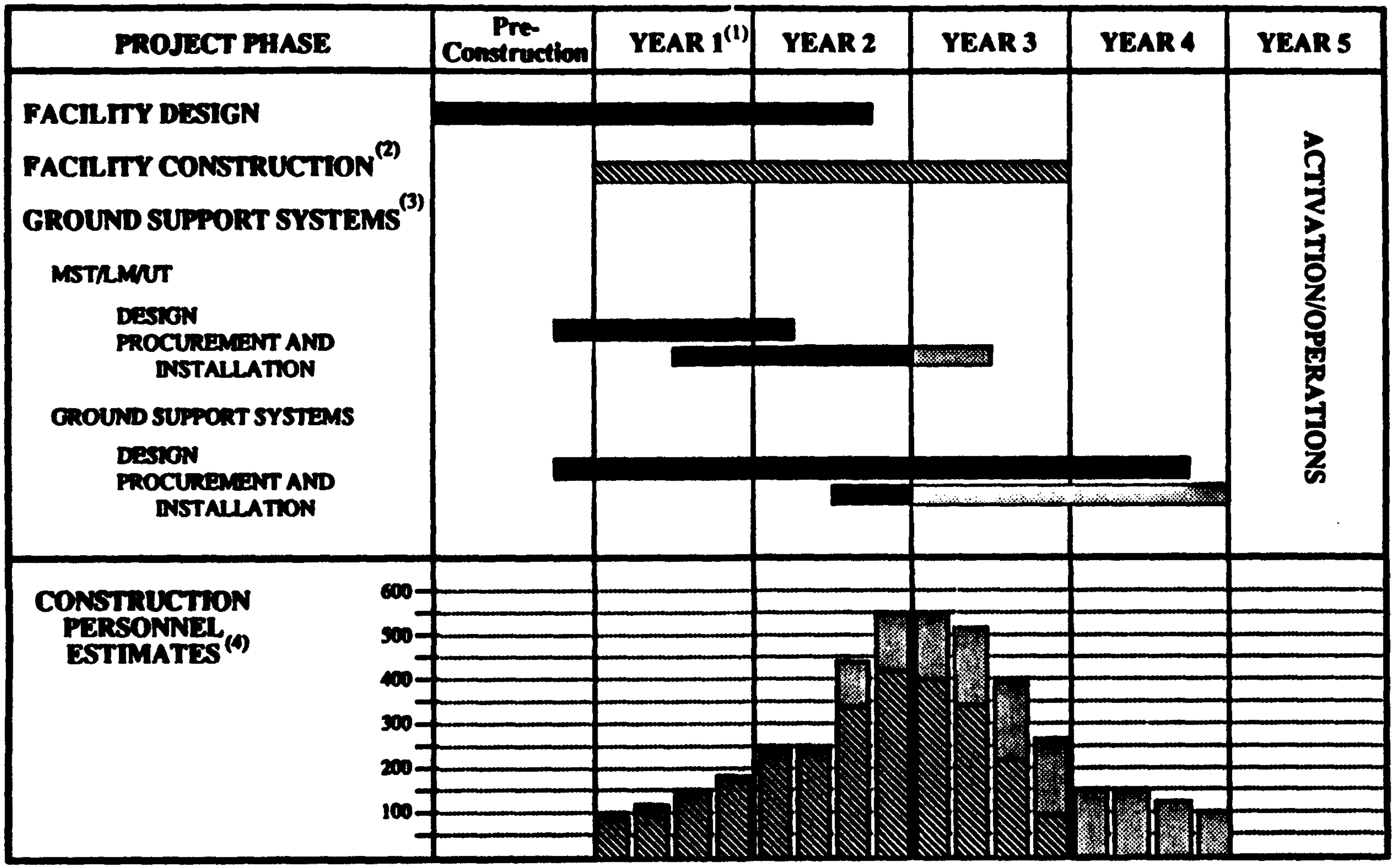
- Facility Construction (36 months) - involves facility design, grading, utility and road construction, Operations Support Building construction, Launch Service Structure and flame duct construction, fencing, and landscaping.

- Ground Support Systems Design, Procurement, and Installation (42 months) - involves installation of Mobile Service Tower, Launch Mount, Umbilical Tower, storage tanks, and other aerospace ground equipment and systems.

2.1.4.1 Facility Construction

Initial construction activities after final design would primarily entail grading for the project site, the privately-owned vehicle (POV) parking area, roads, and evaporation/percolation ponds.

In order to accommodate the engineering design of the planned 50-acre space launch complex, approximately 120 acres would be disturbed by grading activities, equipment movement and storage, and the establishment of temporary construction "laydown" areas. Depending upon the final design and grading plans, earth movement would involve a minimum about 1.5 million cubic yards (CY) of cut and 1.5 million CY of fill. Between 0.2 and 0.6 million CY of fill would come from borrow areas located on VAFB (see Figure 2.1.11, Proposed Borrow and Spoil Locations). The balance of the unused cut material would be removed from the project area and transferred to a spoil site located about three miles north of the proposed Cypress Ridge site near Point Arguello (see Figure 2.1.11) or other, approved location. The top six inches of topsoil would be removed and stockpiled onsite for re-spreading on disturbed areas for revegetation and erosion control after completion of construction. Appropriate erosion control measures would be implemented at the stockpile.



(1) Years indicated do not necessarily correspond to calendar dates and indicate the least time anticipated for completion of activities. Actual construction may extend through Year 5, with Activation/Operations occurring in Year 6.

(2) Facility construction includes grading, road construction, utilities, Operations Support Building, Launch Service Structure, fencing, and reclamation.

(3) Ground Support Systems include Mobile Service Tower, Launch Mount, Umbilical Tower, and other ground equipment.

(4) Includes USAF, Aerospace, Army Corps of Engineers, and private contractor construction personnel.

On-Site | Off-Site Facility Construction

On-Site | Off-Site Aerospace Equipment Installation

FIGURE 2.1.10

PRELIMINARY CONSTRUCTION SCHEDULE AND PERSONNEL REQUIREMENTS FOR THE PROPOSED ACTION

SLC-7 ENVIRONMENTAL IMPACT STATEMENT

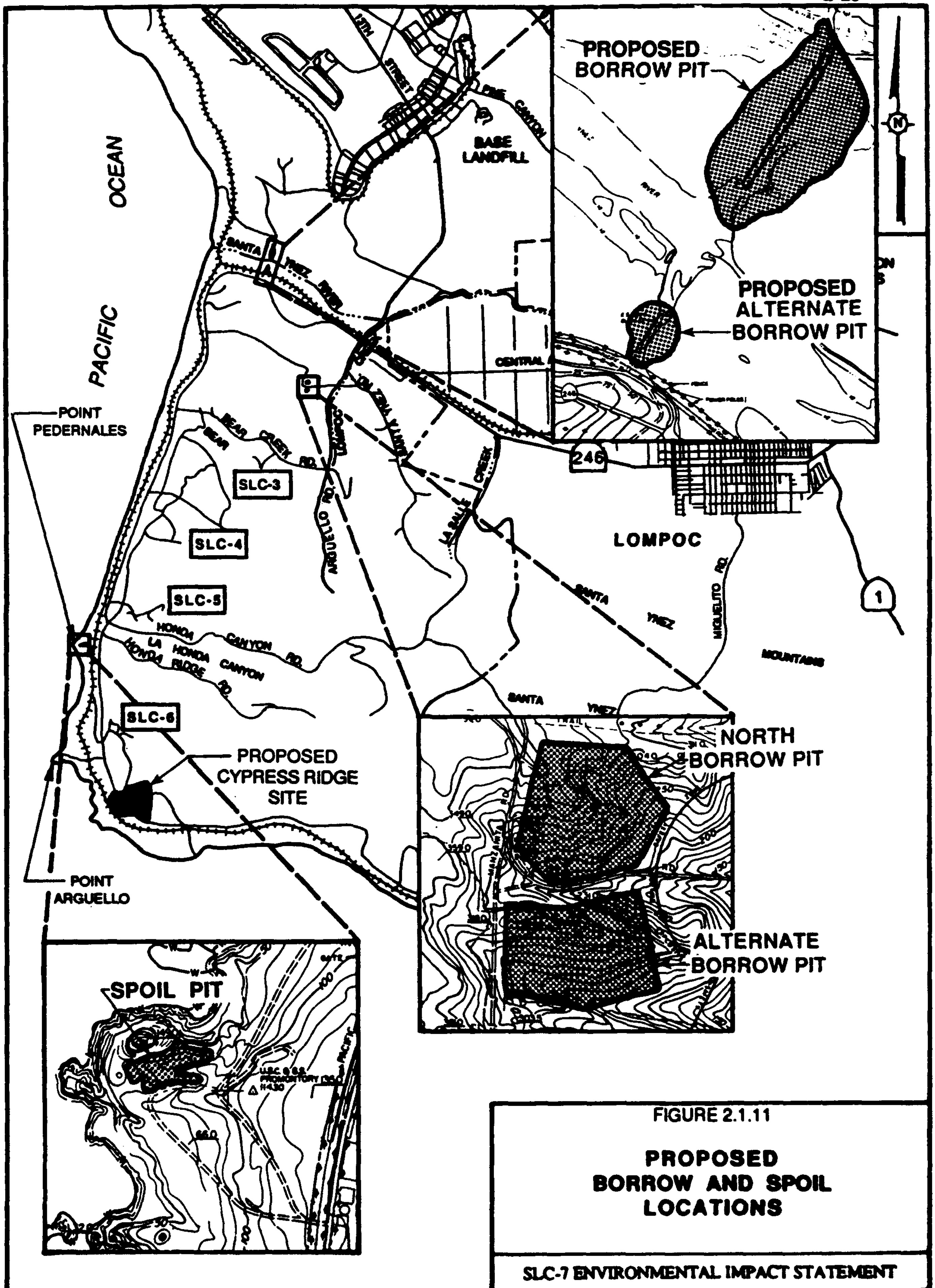


FIGURE 2.1.11

PROPOSED BORROW AND SPOIL LOCATIONS

SLC-7 ENVIRONMENTAL IMPACT STATEMENT

Corridors for communication, water, electrical, and other utilities would temporarily disturb about 65 acres of land. The majority of utility distribution lines are planned to be underground. For electrical power lines, only those portions crossing existing roads or railroads would be located underground. Utilities would be extended within one of two corridors: (1) along the Coast Road from existing lines in the vicinity of SLC-6, or (2) substantially east of Coast Road from the vicinity of the SLC-6 wastewater treatment ponds. These two potential alignments are shown in Figures 2.1.7 and 2.1.8. Water distribution lines would be extended from an existing water storage site located on a knoll about 1.5 miles north and east of the SLC-7 site and from the Space Shuttle External Tank Processing and Storage Facility.

Construction of the SLC-7 facilities would include previously discussed structures, such as the Launch Support Structure, Operations Support Building, and ancillary support facilities. Fencing and landscaping would be completed after construction of these buildings.

It is expected that construction materials generally would be trucked through the South Gate, then over secondary roadways to the Coast Road, the External Tank Tow Route, and the project site. Some construction materials may be generated on VAFB. For example, earth fill is planned to be extracted from local on-base sources. Aggregate and other base material would be obtained off-base.

Laydown areas would be located as shown in Figure 2.1.7. Prior to construction, laydown areas would be cleared, grubbed, and graded. Topsoil would be stored, to be re-spread at completion of construction. Temporary parking would be provided at the site of the future POV parking lot. During construction, this area would be fenced and used for a contractors' village, with temporary mobile office units (trailers), equipment storage area, maintenance facilities, parking, and other construction needs.

A temporary concrete batch plant and truck washdown area would be provided within the boundaries of the laydown area located north of the Space Shuttle External Tank Storage and Check-out Facility. The washdown area would be provided with an impoundment to contain collected washdown water and concrete, to be disposed of at completion of construction in accordance with county and RWQCB regulations. If necessary due to the potential for surface runoff, a non-point source discharge permit would be obtained from the RWQCB. Prior to construction, topsoil would be removed and stored for future reclamation. At completion of construction, the accumulated hardpan would be removed and the area reclaimed, using the stored topsoil and additional revegetation, as necessary.

Employment during the anticipated three-year facility construction phase is expected to range from about 100 to 425 people, with peak facility construction occurring at the end of year two and lasting for about six months (see Figure 2.1.10). Average employment over the three-year period would be about 250 people.

Automobile traffic for the facility construction phase is estimated to average 250 cars per day, based on a worst-case assumption that every employee would drive one car to the site. A maximum of 425 cars per day may occur for a limited duration during peak construction. Truck traffic is estimated to reach a maximum of 45 to 50 trucks per day during the early part of construction when site preparation is being completed, decreasing to approximately 25 to 35 trucks per day toward the end of construction.

2.1.4.2 Ground Support Systems

Ground support systems design, procurement, and installation would be the second phase of construction and would begin approximately 24 months after the start of facility construction. It would consist of the building and installation of equipment directly linked to the vehicle and its performance, such as umbilical systems, flight control devices, and support structures, including the LM, MST, UT, and the propellant holding vessels. Some equipment, such as the MST, would be shipped in modules via shallow-draft ocean barge to the Space Shuttle External Tank Landing Facility, then transported to the site. Employment during this phase is expected to range from about 75 to 175 persons over a period of 2.5 years (see Figure 2.1.10). Associated automobile traffic would reach a maximum of about 175 cars per day during the peak employment period.

Because the facility construction and ground support systems installation phases are expected to overlap for a period of about 18 months, a peak employment period greater than that for either phase alone is expected. This peak is anticipated to occur at the end of year two and last for about six months, with employment peaking at about 550 people per day and automobile traffic expected to reach a maximum of 550 cars per day (see Figure 2.1.10). During the other 12 months of this period, average employment onsite would be about 370 people, with a corresponding maximum of approximately 370 cars per day.

2.1.5 LAUNCH PREPARATION AND OPERATION

The Titan IV/Centaur launch vehicle components would be shipped separately to VAFB. Upon arrival, the components would undergo a variety of receiving inspections and off-line processing before being transported to the SLC-7 launch pad for integration, test, and launch.

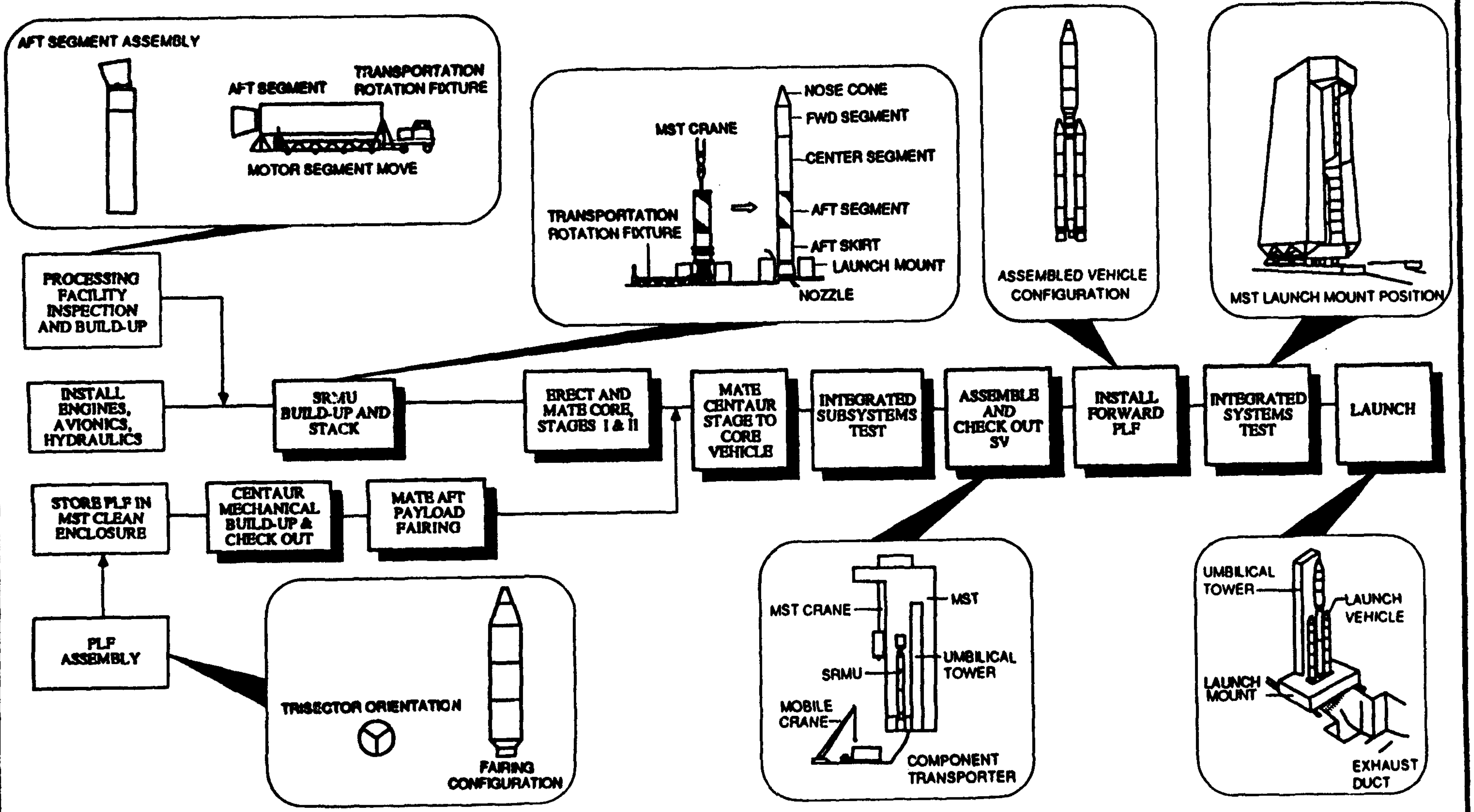
The SRMU segments would arrive by rail at a receiving facility on South VAFB. The Titan IV core vehicle stages I and II would arrive at the airfield on North VAFB and be transported to Building 8401, the Vehicle Assembly Building/Horizontal Test Facility (VAB/HTF). The liquid propellant rocket engines would arrive for installation on the core vehicle at the VAB/HTF. The Centaur stage would be received and sent directly to SLC-7 for processing. The Payload Fairing sections would be trucked to Building 8337, the Payload Fairing Processing Facility, where each would be received, inspected, and processed, then transported to the SLC-7 site.

Launch process operations that would occur at the SLC-7 site include launch preparation, launch operations, and post-launch refurbishment. These activities, planned to begin in 1994 or 1995, are described below.

2.1.5.1 Launch Preparation Activities

Launch preparation activities involve assembly and testing of the Titan IV/Centaur vehicle. Vehicle assembly is depicted in Figure 2.1.12 (Titan IV/Centaur, Typical Vehicle Assembly Flow Diagram). The launch vehicle components and payload elements would be transported to the SLC-7 launch pad from their off-line processing areas or from the point of arrival at VAFB on their individual transporters. The elements would be sequentially erected on the LM. The individual SRMU segments would be erected and assembled, followed by the Titan IV core vehicle, stages I and II, and the Centaur stage with the aft PLF section installed. In this assembled configuration, the booster vehicle would undergo check-outs, including subsystem verification, integrated system tests, and Centaur tests, to verify all systems and interfaces.

Following successful completion of integrated system tests, the satellite would be brought to the launch site and erected in a clean enclosure in the Mobile Service Tower (MST), where pre-launch check-outs would be conducted. Testing would be performed on the satellite to verify interfaces and functions. The forward PLF sections then would be installed.



LEGEND:

MST = MOBILE SERVICE TOWER
PLF = PAYLOAD FAIRING
SV = SATELLITE VEHICLE
SRMU = SOLID ROCKET MOTORS

= DENOTES ON-PAD ACTIVITY

SOURCE: USAF 1988d. OPERATIONS CONCEPT, SLC-7, TITAN IV - CENTAUR LAUNCH VEHICLE. WSMC/ST

FIGURE 2.1.12

TITAN IV\CENTAR TYPICAL VEHICLE ASSEMBLY FLOW DIAGRAM

REVISED 1/29/89

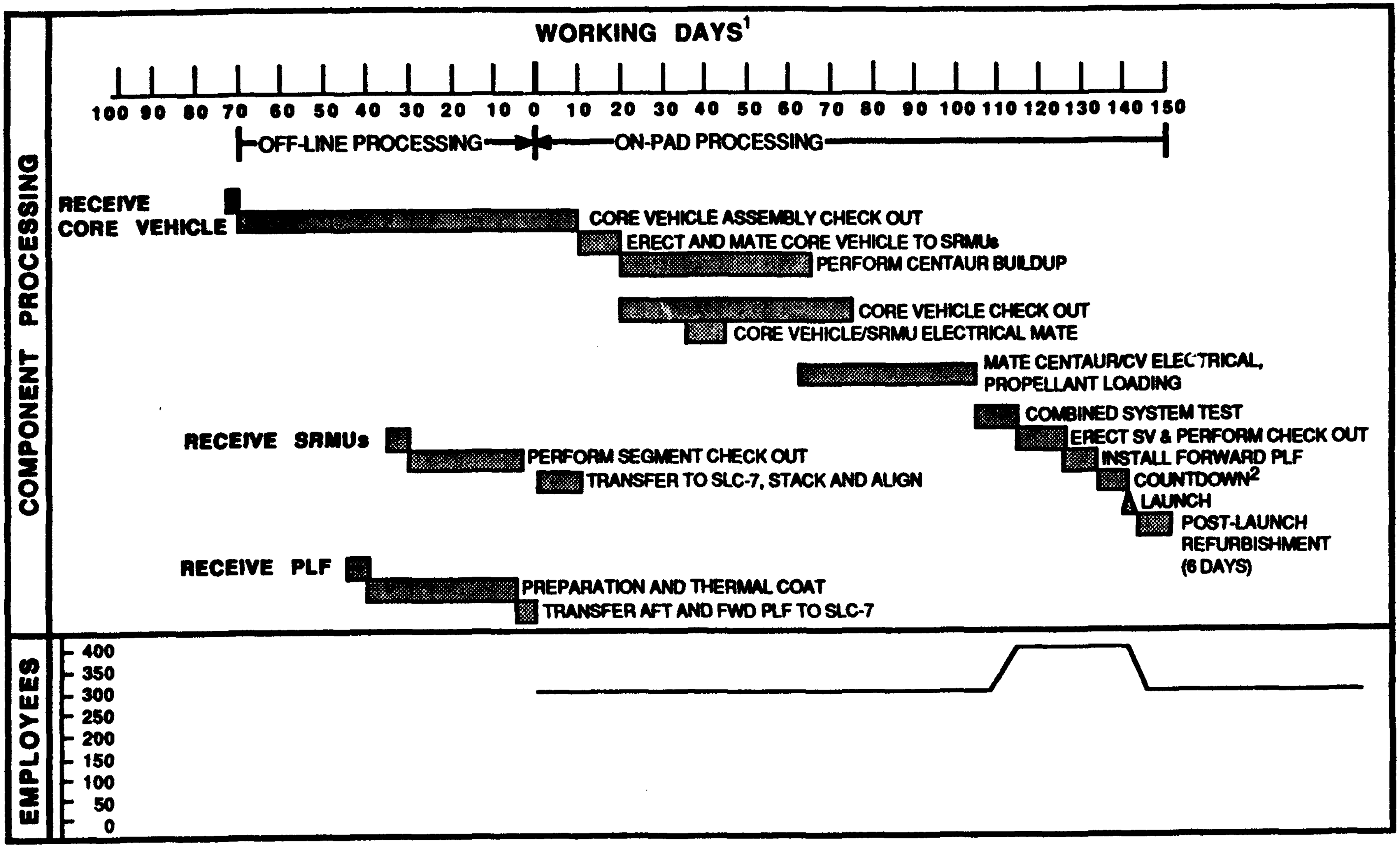
Completion of the vehicle assembly and testing activities leads to a pre-launch phase in which the launch vehicle and payload are prepared for launch countdown. This includes battery installation, propellant loading, ordnance installation (e.g., stage separation charges), and other selected hookups.

Titan IV core vehicle commodity servicing is provided by propellant loading systems (oxidizer and fuel) installed at the launch pad and comprised of ready storage vessels, propellant loading units, and piping. Piping from the LSS and UT would be used to fill and drain umbilical connections from the UT to the vehicle. Centaur stage commodity servicing includes loading of liquid hydrogen, liquid oxygen, gaseous nitrogen, hydrazine, gaseous helium, and liquid helium. Support equipment systems are provided at the launch pad to accommodate these requirements. Propellants would be piped from onsite storage vessels and transfer systems to the launch vehicle through umbilicals at the UT.

Scheduling of launch preparation activities is depicted in Figure 2.1.13 (Titan IV/Centaur, Typical Vehicle Assembly Time Line). As shown, off-line processing of vehicle components would occur over a 70-day period. Components then would be transferred to the SLC-7 site for approximately 150 days of vehicle assembly and testing, which are necessary prior to launch.

2.1.5.2 Launch Operations

Countdown and launch activities are divided into two parts, known as the R-count and terminal count. The R-count begins approximately two weeks prior to launch and involves activities such as installation of flight batteries, oxidizer and propellant loading, and ordnance installation. The terminal count begins about one day prior to launch and includes activities such as Centaur propellant loading, vehicle verification and guidance checks, range safety checks, moving of the MST away from the vehicle, and the final countdown to launch. The launch complex would be evacuated of all non-essential personnel prior to fueling the Centaur stage. After Centaur fueling has started and been stabilized, all other personnel are evacuated.



NOTES

1. Time line shown as working days based on 8-hour/day, 5-day/week schedule.

2. 24-hour/day work schedule.

LEGEND

▲ Component transferred to SLC-7 for integration with core vehicle

Source: USAF 1988d. Operations Concept, SLC-7, Titan IV/Centaur Launch Vehicle, WSMC/ST.

FIGURE 2.1.13

TITAN IV/CENTAUR TYPICAL VEHICLE ASSEMBLY TIME LINE

SLC-7 ENVIRONMENTAL IMPACT STATEMENT

Launches from SLC-7 would be controlled from a LCC located on north VAFB. The LCC would communicate by means of a fiber-optic loop, with a launch complex computer receiving commands from the LCC. The LCC would be used to perform the pre-launch testing and check-out and would run the entire countdown and launch phase. Selected pre-launch onsite testing and check-out functions would be performed at the project site. The terminal launch countdown would start approximately 500 minutes prior to launch and could include built-in time delays. The MST would be moved back to the park position and away from the launch pad during the countdown.

At launch, water would be sprayed at the vehicle exhaust from valves located at the UT, LM, LSS, and exhaust duct. This spray serves the function of exhaust cooling in order to minimize damage to the launch pad. Approximately 26,000 gallons of water could be sprayed during the vehicle launch. Wastewater from this process would pass through the exhaust duct to a retention basin.

2.1.5.3 Post-launch Refurbishment

Following a launch, washdown and cleanup of the launch area would be completed. Post-launch activities would also entail replenishment of commodities such as propellants, cryogenics, and gases, and minor repair to launch support facilities.

Other activities following a launch would be centered on completion of receipt and off-line processing of vehicle components in preparation for the next launch. The initiation of this phase would be concurrent with and overlap the previously described on-pad launch preparation activities.

2.1.6 OVERALL PROJECT SCHEDULE AND PERSONNEL

A schedule for the proposed action, including employee requirements, is shown in Figure 2.1.10. The schedule indicates that the two construction phases would overlap and continue over a period of about four years. Initial launch capability (ILC) is scheduled for 1994 or 1995.

Personnel requirements are estimated to vary from about 550 individuals at the peak of construction activities to about 100 at the termination of construction. Operations personnel are estimated at 300 during normal launch operations. About 400 persons would be onsite during an approximate one-month period prior to launch for final vehicle processing.

As depicted in Figure 2.1.13, the on-pad receipt and processing of Titan IV/Centaur components at SLC-7 would require about 150 working days. Overlap of off-pad processing schedules for some components is planned. Within a period of one year, a maximum of three vehicles could be launched from the Proposed Cypress Ridge Space Launch Complex.

2.2 ALTERNATIVES TO THE PROPOSED ACTION

Alternatives to construction of the proposed action at Cypress Ridge, and to use of the Titan IV/Centaur, have been considered. Alternatives must have the potential to achieve the basic objectives of the proposed action, which are to provide a facility with the capability to launch a Titan IV vehicle to a polar orbit, to achieve highly inclined orbits with payloads in the 10,000-pound class, and to back up existing launch facilities to assure access to space for critical satellite missions. Basic criteria necessary to support this objective include siting of the facility to obtain the proper satellite orbit and availability of support facilities, which include launch support infrastructure, such as a launch control center, telemetry and tracking facilities, propellant storage, and vehicle component processing facilities. In addition, community-provided facilities, such as access roads and utilities (power, sewer, water, and communications), port availability, and employee housing are necessary. Other related considerations include availability of a local work force, construction costs, operation and maintenance costs, and availability of land for the project site. Alternatives that meet these basic criteria are evaluated to determine if they are capable of eliminating significant adverse environmental effects or reducing adverse effects to a level of insignificance.

Feasibility criteria are reviewed in the following sections for alternate launch vehicles, other launch locations, existing VAFB launch sites, alternate VAFB SLC-7 sites, and the "no action" alternative. Three alternative sites are evaluated in detail along with the proposed action in this Draft EIS.

2.2.1 OTHER LAUNCH VEHICLES

2.2.1.1 Space Shuttle

The Space Shuttle program resumed launches in 1988 at NASA's Kennedy Space Center, Florida, following the more than two-year delay resulting from the January 1986 Challenger accident. The Space Shuttle vehicle is not available for launches from VAFB, and launches from Cape Canaveral in Florida cannot safety provide a polar orbit. Since one element of the project objective is to launch critical DOD payloads into near-polar orbit, use of the Space Shuttle has been determined not to be viable and has been eliminated from further consideration.

2.2.1.2 <u>Other Vehicles</u>

Use of other available launch vehicles was considered relative to the desired mission objectives. The current Titan IV/NUS can achieve a low energy, but not a high energy, orbit. Other available launch vehicles are designed for lighter weight payloads. For example, the Titan 34D can deliver a 27,500-pound satellite to low earth orbit. However, modification for a high earth orbit reduces its capacity to approximately 4,200 pounds.

Since the objective of the proposed action includes launching satellites in the 10,000-pound class to a high energy orbit, the Titan IV/Centaur is required.

2.2.2 OTHER LAUNCH LOCATIONS

2.2.2.1 <u>Existing Government Sites</u>

<u>Cape Canaveral Air Force Station/Kennedy Space Center</u>

Facilities are available to launch the Titan IV/Centaur at the Eastern Test Range (ETR) (Cape Canaveral Air Force Station). Launch azimuths from the ETR are generally limited to between 35 and 120 degrees, as shown in Figure 1.3.1. Consequently, space vehicles launched from this location cannot safely achieve polar orbit.

<u>Naval Pacific Test Range</u>

The U.S. Department of the Navy maintains a missile test range base on San Clemente Island, off the coast of Southern California. It is operated by the Naval Pacific Test Range, located at Point Mugu Naval Air Station, California. Use of the Navy's Pacific Test Range for launch of the Titan IV/Centaur would permit attainment of a polar orbit. However, the specific launch support infrastructure that currently exists on the island is not capable of accommodating the large Titan IV/Centaur space launch vehicle.

Location of the space launch complex on this island was eliminated from further consideration based primarily upon the lack of available launch support work force, housing, and infrastructure, which includes power, sewer, water supply, communications, and vehicle and payload processing and preparation facilities.

2.2.2.2 Remote, Undeveloped Sites

Territories/Possessions of U.S.

The proposed action could be constructed at another Pacific location, thereby enabling a near polar orbit to be achieved. Available locations to accomplish this objective are primarily located on remote islands in the South Pacific Ocean. However, necessary community support facilities, including access roads, adequate utilities (power, sewer, water supply, and communications), and port access, if available, are generally not adequate on these islands. Additionally, there is only limited availability of a trained local work force and employee housing. Further, there would be the need to establish an entirely new launch support infrastructure, which would include a new launch control center, telemetry and tracking facilities, propellant storage, and vehicle component processing facilities.

It is anticipated that environmental considerations for construction of a new space launch complex at a South Pacific location would be similar to or greater than those at the proposed VAFB site. Additional issues of environmental concern, including expanded land use and land restrictions, could occur, since the complex would be independently located, could not share existing facilities, and would likely be lacking a suitable supporting infrastructure. This alternative was, therefore, eliminated from further consideration.

Hawaii

The state of Hawaii has been evaluated as a potential site for space vehicle launch activities. In two separate reports prepared by Arthur D. Little, Inc. (1987, 1988), Hawaii was evaluated as being in an advantageous position to serve the market for commercial launch services for small and mid-sized payloads.

The study concluded that, "... a launch facility developed on Hawaii should be designed to fill a niche market: the launch of small to mid-sized commercial payloads. Such a launch facility would be of modest size, of a scale similar to Wallops Island" (Arthur D. Little, Inc. 1987). This assessment was based on the market outlook for launch services and the availability of launch capacity at existing ranges.

The feasibility of Hawaii as a launch site was considered for its potential to provide launch services as a small to mid-size facility serving commercial and scientific markets. The potential sites were identified and evaluated for their ability to accommodate expendable launch vehicles in the size range of the Scout vehicle and not larger than the commercial Titan III.

Based on the results of these studies, and the inherent limitations of the identified sites to accommodate military requirements for facilities of the size and complexity required for the proposed action, this alternative was eliminated from further consideration.

2.2.3 VAFB LAUNCH SITES

2.2.3.1 Sites Considered and Rejected

VAFB is the primary location for launching USAF space vehicles that must achieve near polar orbit. The base has an array of launch complexes to support the current range of launch activities. Support systems, such as centers for launch control, component receipt and processing facilities, warehouses, roads and utilities, are available. Neighboring communities supply labor from an available work force.

An alternative to constructing a new launch complex would be to raze and reconstruct or to modify one of the existing SLCs for the Titan IV/Centaur. SLC-2 (Delta) is located on North VAFB, and, although it has current mission requirements, the Delta program is in a phase-out period. Use of SLC-2 would require razing and reconstruction to meet Titan IV/Centaur requirements. More important, however, North VAFB locations require a dog-leg maneuver to avoid over-flight of populated areas. This maneuver reduces the required payload capacity below the required 10,000 pounds necessary for a high earth orbit.

Launch facilities located on South VAFB consist of SLC-3 (Atlas), SLC-4 (Titan), SLC-5 (Scout), and SLC-6 (Space Shuttle). SLC-5 (Scout) has scheduled missions. SLC-4 East is being refurbished to accommodate Titan IV/NUS missions, and SLC-4 West is an operational Titan II facility. These launch complexes are functional and operating for mission-specific launches. Since each existing launch complex is necessarily designed to accommodate a particular launch vehicle, reconstruction or modification for the Titan IV/Centaur would reduce the base capabilities for these vehicles.

SLC-3 (Atlas) also has current mission requirements but is in a phase-out period. Although located on South VAFB, the SLC-3 complex at launch requires direct over-flight of existing SLC-4 and SLC-6 facilities. Also, SLC-3 is too small in its current configuration to accommodate the Titan IV/Centaur and would require significant demolition prior to building. Additionally, SLC-3 is closer to Lompoc than other space launch facilities on South VAFB, and Titan IV/Centaur activities there would result in increased impacts to the Lompoc community.

Based on the above considerations, SLC-2, SLC-3, SLC-4, and SLC-5 were eliminated from further consideration. However, based upon the range of alternatives considered, it was determined that development of the Titan IV/Centaur program at another VAFB location would be reasonable, based upon mission requirements, technical needs, engineering and design factors, cost, and environmental factors. Therefore, three alternative sites were identified, to be analyzed in detail in the Draft EIS. Known as SLC-6, Boathouse Flats, and Vina Terrace, these three alternatives are introduced below, in Sections 2.2.3.2, 2.2.3.3, and 2.2.3.4.

2.2.3.2 SLC-6 Alternative

Introduction

VAFB covers about 98,400 acres of land bordering the Pacific Ocean. While this area is large, the sites available for new launch complexes are limited, due to factors including topography, access, environmental constraints, and proximity to other space launch complexes, since they must be spaced at appropriate distances according to the required Safety Clear Zone. Based upon these siting factors and mission requirements, appropriate sites for locating the SLC-7 complex are generally restricted to South VAFB. In this area, three sites in addition to the proposed Cypress Ridge site have been selected for engineering and technical evaluation: (1) SLC-6, (2) Boathouse Flats, and (3) Vina Terrace. These locations are shown in Figure 2.2.1 (Project Alternatives, Access and Utility Corridors). The proposed Cypress Ridge and alternative Boathouse Flats and Vina Terrace sites are undeveloped and located in an area of South VAFB that is utilized for grazing. The SLC-6 site is a developed space launch complex, with facilities which were modified for the Space Shuttle.

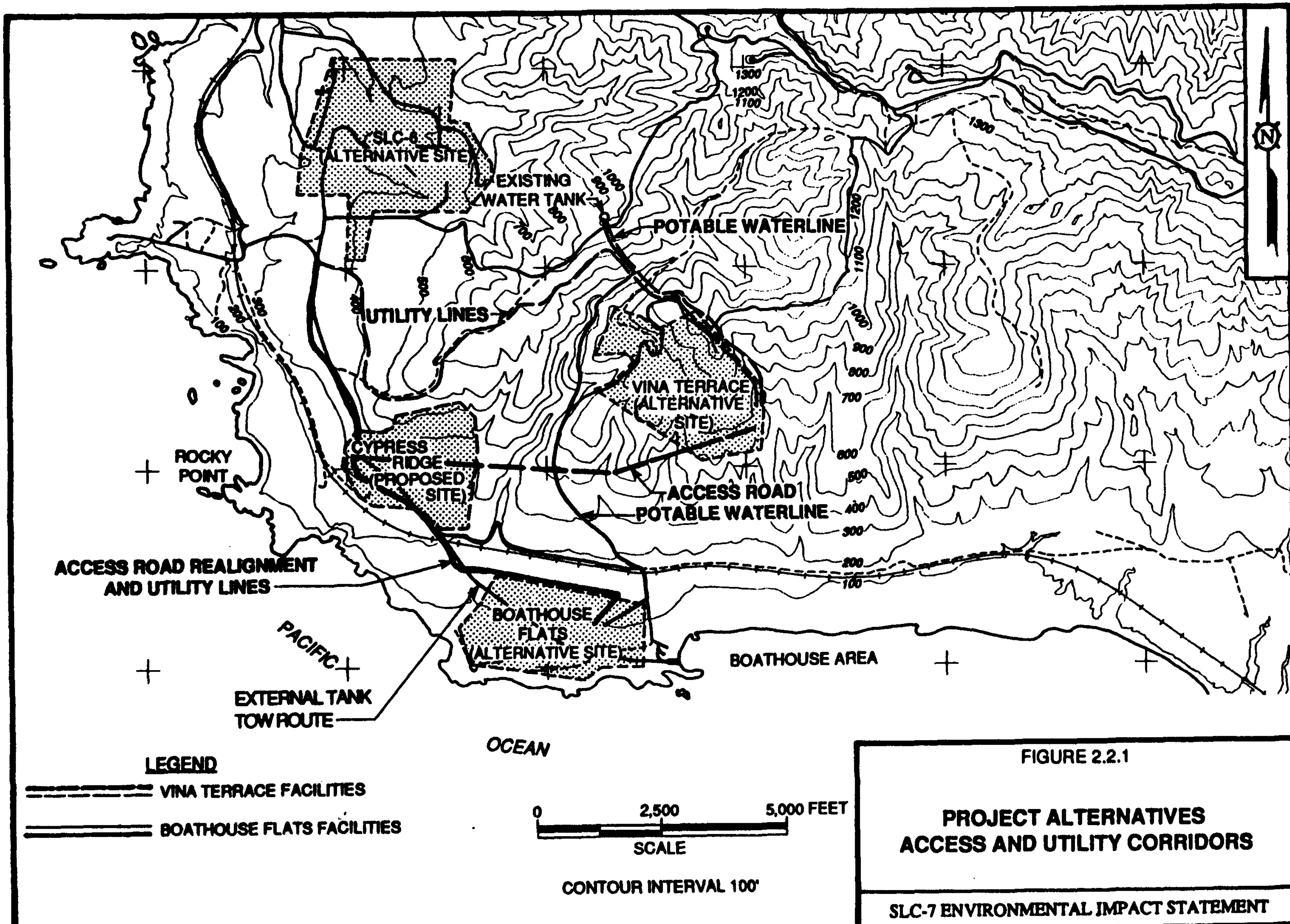


FIGURE 2.2.1

PROJECT ALTERNATIVES
ACCESS AND UTILITY CORRIDORS

SLC-7 ENVIRONMENTAL IMPACT STATEMENT

REVISED 3/8/88

Launching the Titan IV/Centaur from SLC-6 would involve establishment of the same facilities and procedures as proposed for the Cypress Ridge site, but located at SLC-6. The SLC-6 site was originally constructed in 1970 for the Titan IIIM manned launch space vehicle. The Titan IIIM was to be used for the Manned Orbital Laboratory (MOL) program. Subsequent to cancellation of the MOL program, the SLC-6 site was modified for the Space Shuttle. However, primarily as a result of the 1986 Challenger disaster, the USAF has not used SLC-6 for Shuttle launches. Use of the facility to fulfill the objectives of the SLC-7 project would result in utilization of some of the structures and equipment intended for the Space Shuttle program.

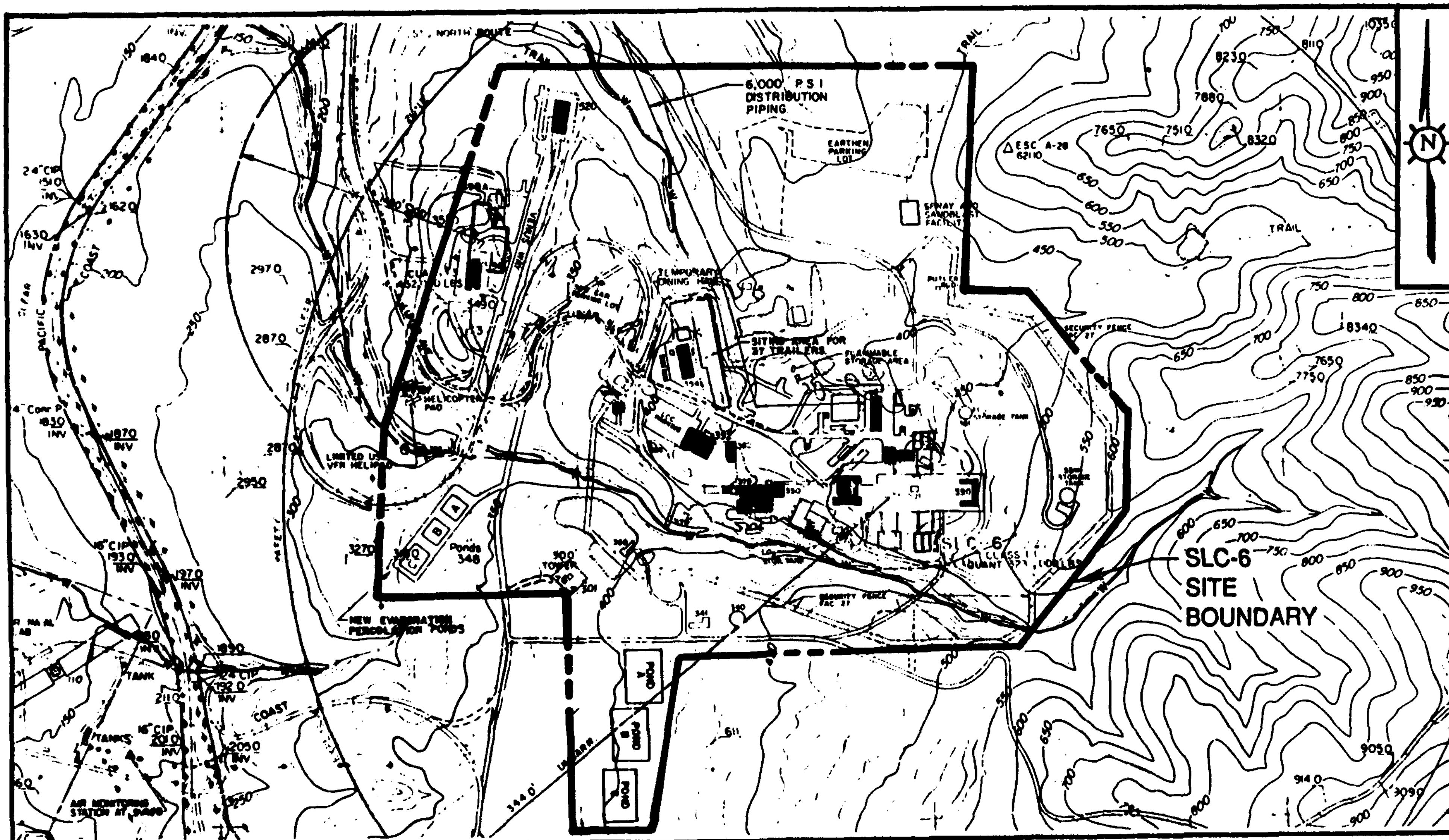
The SLC-6 facility is located about one mile north of the proposed Cypress Ridge site and about one mile inland from the Pacific Ocean. The fenced SLC-6 complex covers an area of about 100 acres, although the total area that would be utilized for Titan IV/Centaur launches is estimated to be about 280 acres, as shown in Figure 2.2.2 (SLC-6 Alternative). Access to SLC-6 is primarily through the VAFB South Gate, as shown in Figure 2.1.1. The location of SLC-6 in relation to the proposed Cypress Ridge and alternative Boathouse Flats and Vina Terrace sites is shown in Figure 2.1.2.

Project Facilities

As planned, implementation of the SLC-6 alternative would involve retention of some facilities, modification of others, and demolition of some. All construction or modification activities for the Titan IV/Centaur are planned to occur in areas disturbed by previous construction. A list of major facilities and their utilizations, given implementation of the SLC-6 alternative, is shown in Table 2.2.1 (Existing SLC-6 Facilities and Proposed Utilization). The existing site configurations for the Space Transportation System (STS) which would be utilized for the Titan IV/Centaur is shown in Figure 2.2.3 (SLC-6 Launch Complex).

The project components for the SLC-6 alternative essentially would be the same as those proposed for the Cypress Ridge site (see Section 2.1). The primary differences would involve the onsite presence of the Payload Changeout Room (PCR), Payload Processing Room (PPR), and Shuttle Assembly Building (SAB).

The PCR is not planned for use with the Titan IV/Centaur. This facility would be rolled back to the PPR so that it would be out of the way of ongoing activities. The PPR would be used for processing payloads to be launched from various facilities at VAFB.



0 800 1,600 FEET

SCALE

CONTOUR INTERVAL: 10 FEET

TOPO: MAPPING DONE BY INTERNATIONAL MAPPING CORPORATION, L.A., CALIF.

FIGURE 2.2.2

SLC-6 ALTERNATIVE

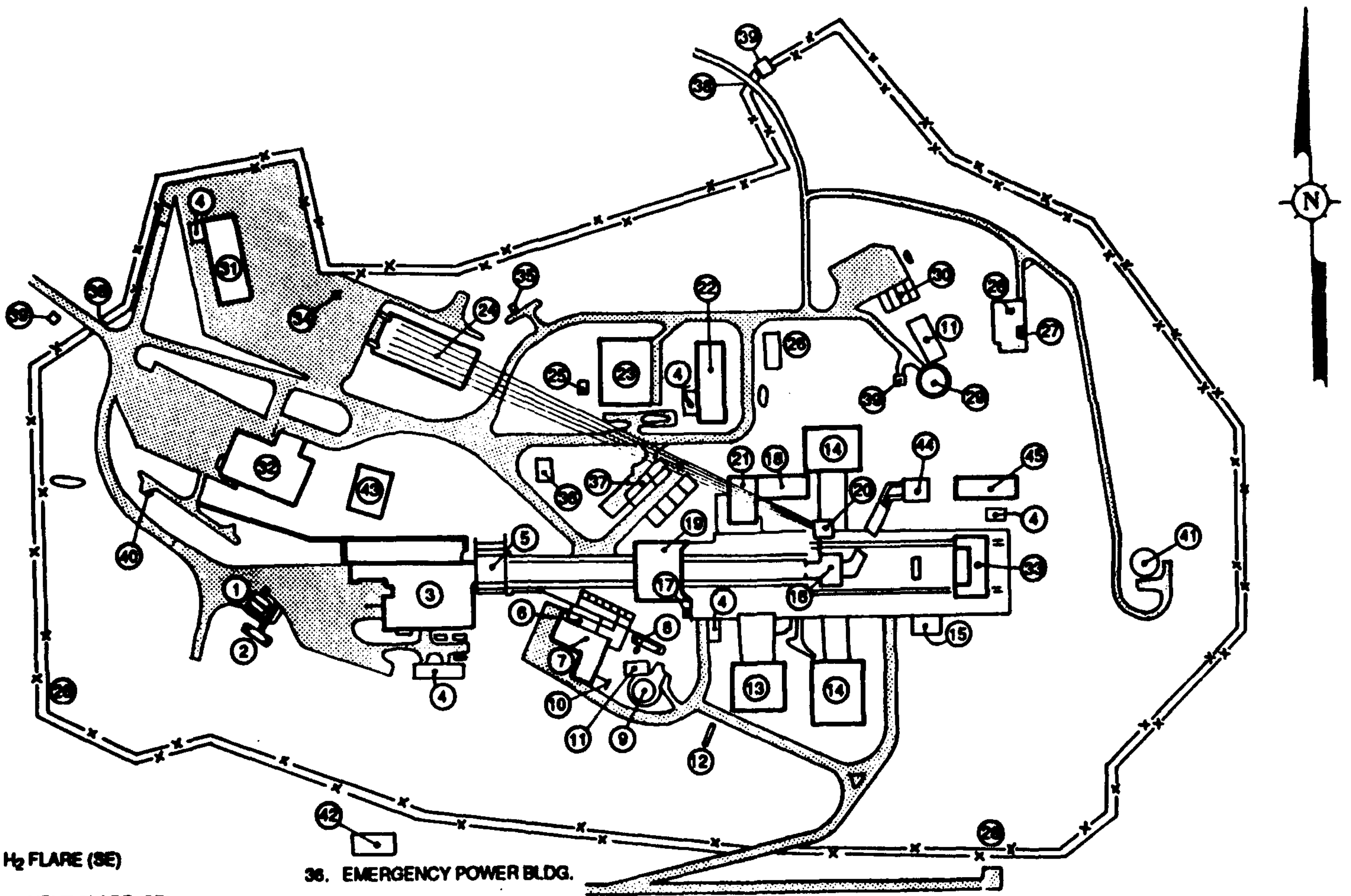
SLC-7 ENVIRONMENTAL IMPACT STATEMENT

REVISED 3/8/89

TABLE 2.2.1

EXISTING SLC-6 FACILITIES AND PROPOSED UTILIZATION

FACILITY	STATUS: UTILIZED IN PRESENT CONFIGURATION	STATUS: UTILIZED WITH MODIFICATIONS	STATUS: MOTHBALLED OR UTILIZED FOR OTHER PROJECTS	STATUS: DEMOLITION	PROPOSED UTILIZATION
Payload Processing Room (PPR)			X		Utilized in present configuration
Payload Changeout Room (PCR)			X		Backed up to PPR
Shuttle Assembly Building (SAB)	X				Utilized in present configuration
Access Tower		X			Modified to accommodate Titan IV/Centaur
Aerial Escape Tram				X	Disassembled and disposed of offsite
Launch Mount (LM)				X	Subject to demolition
Launch Exhaust Ducts (LD)		X			Modified to accommodate Titan IV/Centaur.
Mobile Service Tower (MST)		X			Interior to be modified from Shuttle to Titan IV configuration
Operations Support Building (OSB)	X				Modified to accommodate Titan IV/Centaur
Launch Control Center (LCC)		X			Utilized for office space
Security Systems, guard shack		X			Completed, modify as necessary
Hydrazine Storage and Transfer		X			Modified, prepared for use, APCD permit
Nitrogen Tetroxide (N_2O_4) Storage and Transfer		X			Modified, prepared for use, APCD permit
Cryogenic Storage Areas		X			Modified, prepared for use
Industrial Wastewater Treatment Facility		X			Modified with addition of equipment and storage capacity, cleaned, prepared for operation.
Deluge Water Transfer System	X				Inspected, cleaned, prepared for operation
Communications System		X			Modified to accommodate Titan IV/Centaur
Utilities					Inspected, cleaned, prepared for operation
Water	X				
Electricity	X				
Propane	X				
Sewage Disposal	X				
Water Tank	X				Inspected, cleaned, prepared for use
POV Parking	X				Utilized in present configuration



LEGEND

1. SE PROPELLANT PADS
2. CONTAMINATED HYPERGOLIC WASTE TANK
3. PAYLOAD PREPARATION ROOM
4. ELECTRICAL SUBSTATION
5. PAYLOAD CHANGEOUT ROOM
6. OXIDIZER HOLDING AREA
7. OXIDIZER UNLOADING AREA
8. OXIDIZER VAPOR BURNER
9. LO_2 STORAGE TANK
10. GO_2 STORAGE
11. VAPORIZER PAD
12. LO_2 WASTE TANK
13. SSME EXHAUST DUCT
14. SRB EXHAUST DUCT
15. FACILITY VALVE PIT
16. LAUNCH MOUNT
17. ELECT. EQUIP. BLDG.
18. AIR CONDITIONING SHELTER
19. SHUTTLE ASSEMBLY BLDG.
20. ACCESS TOWER
21. SUPPORT EQUIP. BLDG.
22. COMPLEX SERVICE BLDG.
23. GAS STORAGE AREA
24. SLIDEWIRE EMERGENCY EGRESS LANDING AREA
25. FAN HOUSE
26. H_2 FLARE (SE)
27. H_2 VENT FLARE (SE)
28. EMERGENCY EGRESS GATE
29. LH_2 STORAGE AREA
30. FUEL UNLOADING AREA
31. READY BLDG.
32. LAUNCH CONTROL CENTER (V28)
33. MOBILE SERVICE TOWER
34. AIR INTAKE
35. FLAMMABLE STORAGE BLDG.
36. EMERGENCY POWER BLDG.
37. FUEL HOLDING AREA
38. GATE
39. GUARD SHELTER
40. PUMP HOUSE
41. SPACE SHUTTLE WATER STORAGE TANK
42. WASTEWATER TREATMENT FACILITY
43. OPERATIONS SUPPORT BUILDING
44. ICE SUPPRESSION SYSTEM BLDG.
45. JP-4 FUEL AREA

0 500 1000 FEET

SCALE

FIGURE 2.2.3

SLC-6 LAUNCH COMPLEX

SLC-7 ENVIRONMENTAL IMPACT STATEMENT

With this alternative, the SAB would be utilized as an all-weather enclosure during the vehicle integration and preparation phases of the launch cycle. During final pre-launch activities, the SAB would be backed away for vehicle preparation and launch. The existing Mobile Service Tower (MST) would be utilized after extensive modifications to interior structures. The MST was originally built for the Titan IIIM and modified for the Space Shuttle. It would be re-configured to accommodate the Titan IV/Centaur. The existing Access Tower also would be modified for the Titan IV/Centaur. The slidewire emergency egress (aerial escape tram) would be removed since Titan IV launches are unmanned.

The existing launch mount (LM), designed for the Space Shuttle, would be demolished and replaced by a structure designed for the Titan IV. The launch exhaust ducts, designed for the Space Shuttle, would be modified to suit the Titan IV configuration. The single main engine duct would be fitted with a permanent closure cap. A portion of the wall separating the two Solid Rocket Booster (SRB) ducts would be removed and modified so that launch exhaust would flow into both ducts.

Other major onsite facilities which would be modified or upgraded for the requirements of the proposed action include the communications system, and security system and guardhouse. Some facilities/systems which were constructed for the Space Shuttle would be inspected and brought to full operational capability for the proposed action. These include, but are not limited to, the hydrazine and N_2O_4 storage and transfer systems, the industrial wastewater treatment facility, evaporation ponds, water tank, and utilities (water distribution, electricity, natural gas, sewage disposal). The Personally Owned Vehicle (POV) parking area would be located in its present location northwest of the fenced launch site. Other systems built for the Space Shuttle, such as the Ice Suppression System (ISS) and Launch Control Center (LCC), would not be used for the Titan IV/Centaur. Also present at SLC-6 are several underground diesel fuel and jet fuel storage tanks. These tanks would have to meet all current regulations before being utilized for the Titan IV program.

<u>Project Construction</u>

Implementation of the SLC-6 alternative would involve major demolition prior to construction of new project facilities and modification of existing facilities. The concrete and steel LM would be removed at the surface, producing approximately 1,200 tons of steel and 1,800 cubic yards of concrete. The access tower would be modified in accordance with Titan safety directives.

Concrete from the LM would be disposed of at an approved VAFB spoil site, and steel would be salvaged for scrap. Demolition would be accomplished primarily by using jackhammers to crack the concrete and torches to cut through the steel reinforcing bars.

Subsequent to demolition, modification to existing facilities and construction of new facilities would begin. Overall, facility preparation is expected to occur over a period of four years. Demolition is expected to take about six months, with construction and modification of other facilities occurring over a 30-month period. Final preparation of aerospace equipment would occur over the final 12 months. Construction employment is expected to range from approximately 100 to 300 people, with an average over the four-year period expected to be about 200.

Automobile traffic is expected to average 200 cars per day, based on a worst-case assumption that every employee would drive one car to the site. A maximum of 350 cars per day may occur for a limited duration during peak construction. Truck traffic is estimated to reach a maximum of 35 to 40 trucks per day during the early part of construction, when demolition and site preparation are being completed, decreasing to about 20 to 30 with the completion of construction.

Project Operation

For the most part, project operations would be the same as for the proposed action at Cypress Ridge. However, the onsite location of the industrial wastewater treatment facility would simplify some procedures. The industrial wastewater treatment facility would be located approximately 600 feet from the launch exhaust ducts (LD) where the deluge water would be collected. The existing system would be utilized to pump the deluge water from the launch duct to the treatment facility.

Other operational procedures would be the same as for the proposed action at the Cypress Ridge site.

2.2.3.3 Boathouse Flats Alternative

Description

A 130-acre site known as Boathouse Flats is located adjacent to the coastline, south of the proposed Cypress Ridge site. The site is relatively level, with elevations ranging from 50 to

150 feet. This alternative site was selected based upon an anticipated reduction of project costs and engineering requirements from grading, access, and utilities extensions. A preliminary plan for the SLC-7 project at Boathouse Flats is shown in Figure 2.2.4 (Conceptual Site Layout, Boathouse Flats Alternative).

Grading for the launch complex at this site would require about 0.6 million CY of cut and about 0.4 million CY of fill. A maximum of 0.4 million CY of fill would be taken from a borrow area located on VAFB (see Figure 2.1.11). The amount of fill would depend on the suitability of the cut material for use as fill, thereby affecting the amount ultimately needed.

The Space Shuttle External Tank Tow Route bisects the site and would provide access. Some modifications to the tow route would be necessary. Electricity, underground piping, and communications would be extended to the site from SLC-6, along the existing Coast Road and External Tank Tow Route, then along the northern boundary to the launch complex. The area of disturbance for utilities would be about 90 acres, as shown in Figure 2.2.1. A distribution line for potable water would be extended about two miles from the existing water tank, disturbing an area of about one acre.

2.2.3.4 Vina Terrace Alternative

The alternate site known as Vina Terrace is located about one-half mile east of the proposed Cypress Ridge site. It occupies about 150 acres on a westerly sloping terrace at an elevation between 600 and 800 feet. This alternative site was selected based upon an anticipated reduction in impacts to cultural resources. The complex would require grading in the amount of about 10 million CY of cut. (No fill is anticipated.) It also would require construction of a new access road approximately three miles in length. A plan for the SLC-7 project at Vina Terrace is shown in Figure 2.2.5 (Conceptual Site Layout, Vina Terrace Alternative).

To accommodate the six percent road grade limitation for transportation of vehicle components, an access road would be extended about one and one-half miles from the Coast Road, primarily winding along a ridge top (see Figure 2.2.1). Utilities, including electricity, underground piping, and communications, would be extended along this new roadway. The area of disturbance for the road and utilities would be about 100 acres.

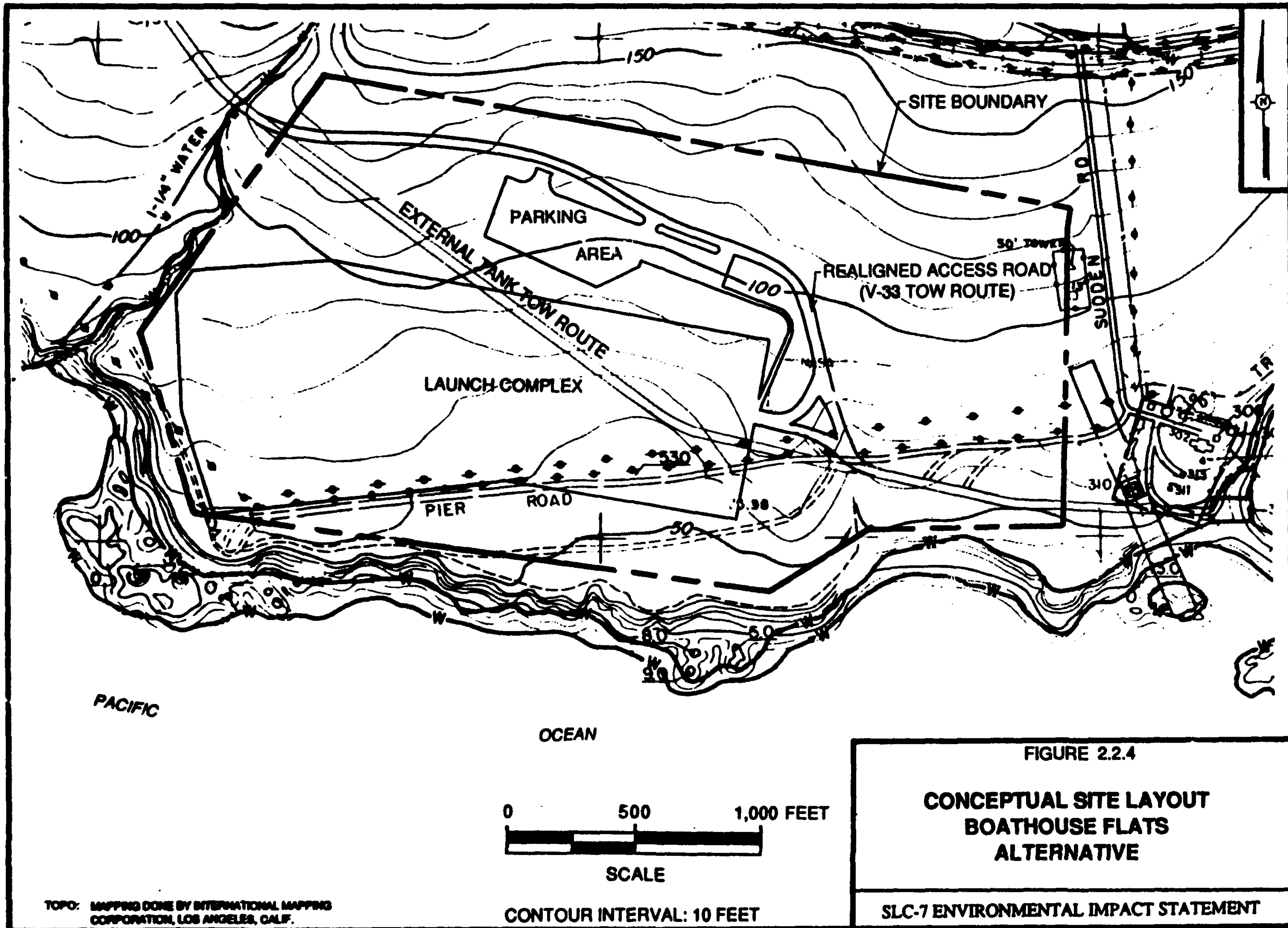
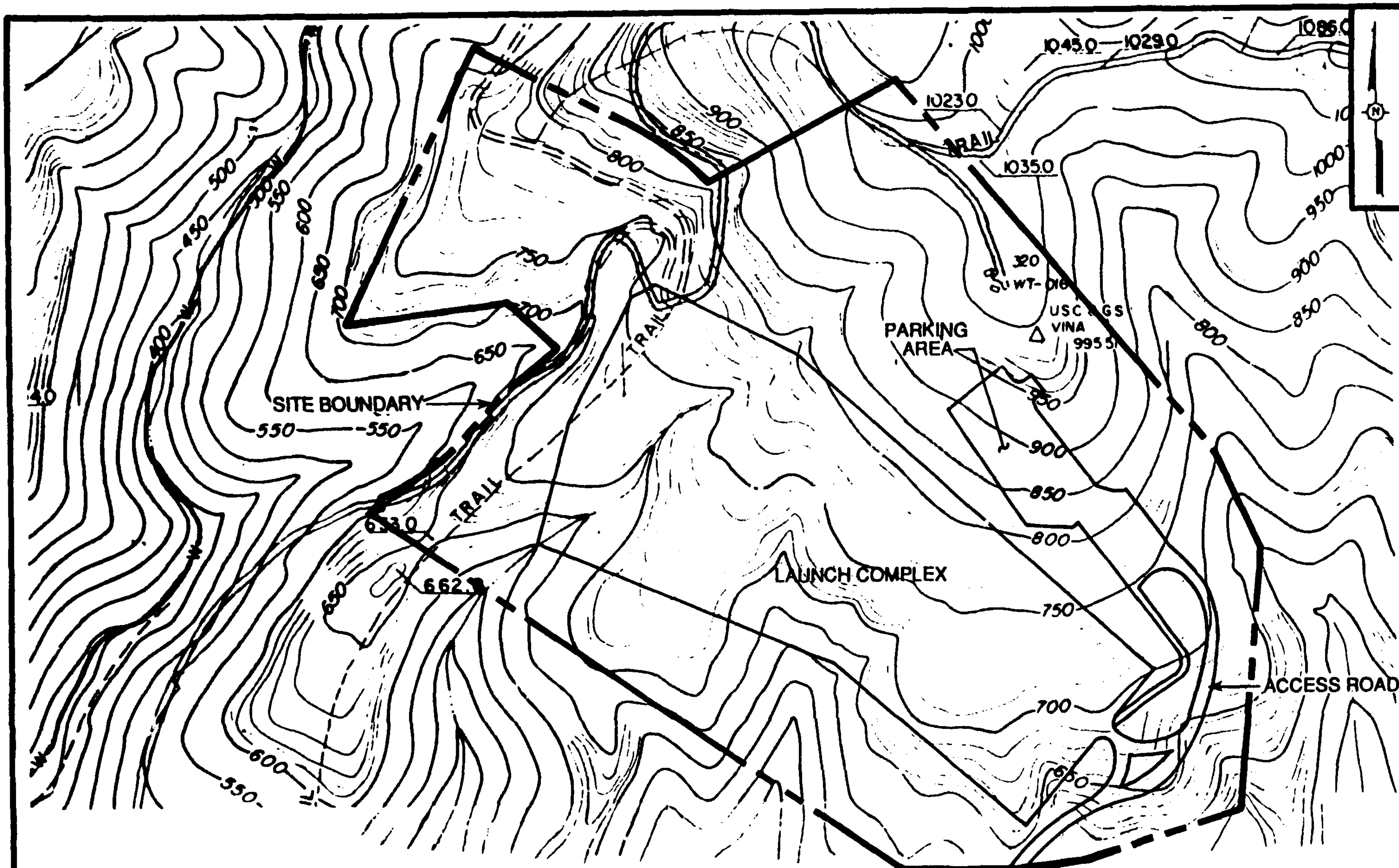


FIGURE 2.2.4

CONCEPTUAL SITE LAYOUT BOATHOUSE FLATS ALTERNATIVE

SLC-7 ENVIRONMENTAL IMPACT STATEMENT

REVISED 4/6/89



0 500 1,000 FEET

SCALE

CONTOUR INTERVAL: 10 FEET

TOPO: MAPPING DONE BY INTERNATIONAL MAPPING CORPORATION, LOS ANGELES, CALIF.

FIGURE 2.2.5

CONCEPTUAL SITE LAYOUT VINA TERRACE ALTERNATIVE

SLC-7 ENVIRONMENTAL IMPACT STATEMENT

REVISED 4/6/89

2.2.4 NO ACTION ALTERNATIVE

If the Titan IV/Centaur (SLC-7) project proposed for VAFB were not implemented, the USAF would not be able to achieve the required high energy, near polar orbit for Department of Defense (DOD) satellites in the 10,000-pound class, and there would not be backup launch capability for other Titan IV/Centaur and Titan IV/NUS vehicles. The absence of this capability would unacceptably impact national security, since current defense programs rely on attainment of the capability to launch heavy payloads into near polar orbit.

If the no action alternative were pursued, the Titan IV/Centaur program would not be developed at VAFB. As a consequence, potential adverse environmental impacts of program implementation would be avoided. Since there are no other space launch vehicles available to meet mission requirements, there would be no displacement effect to result in environmental impacts elsewhere.

2.3 COMPARATIVE ANALYSIS OF PROPOSED ACTION AND ALTERNATIVES

This section presents a comparative analysis of the proposed action and alternatives, prepared in compliance with Section 1502.14 of the CEQ guidelines for preparation of an Environmental Impact Statement. A summary comparison of potential environmental effects of the proposed action and alternatives is presented in Table 2.3.1 (Comparative Summary of Impacts, Space Launch Complex 7). The table presents comparisons of potential effects to specific environmental discipline/resource areas and compares the potential effects among the proposed action and three alternatives. Four symbols are used to indicate the extent of impact, ranging from least impact (indicated by ○), to low intermediate (indicated by ⊗), to high intermediate (indicated by ◐), to most impact (indicated by ●). For example, an impact that would be the same under more than one of the alternatives is shown as Ø. In the event that two or three of the project alternatives would have the same relative impact, then these would show the same symbol. For example, under Geology and Soils - Excavation, the SLC-6 alternative is ○, Boathouse Flats alternative is ⊗, Cypress Ridge ◐, and Vina Terrace ●. This indicates that, for the SLC-7 project, the SLC-6 site would require the least excavation, and the Vina Terrace site would require the most excavation. The Cypress Ridge site, with a ◐, would require more excavation than Boathouse Flats ⊗, but less than Vina Terrace.

It should be noted that the comparisons shown in Table 2.3.1 are relative and do not indicate an absolute level or magnitude of impact. Therefore, although the level of effect may be greater at one site than at another, the actual effect on the environment may be minimal or insignificant. Further, the ratings are not intended to provide a mechanism for comparison of effect between categories. Therefore, a ○ in one category could indicate an effect either greater or lesser than a ○ in another category. The symbols provide a mechanism for comparisons within a category. They do not provide sufficient information to compare impacts between categories. Detailed discussions of potential effects are presented in appropriate sections of Chapter 4.0, Environmental Consequences and Mitigation Measures.

2.3.1 GEOLOGY AND SOILS

Regional geologic impacts would be related to earthquake effects. The effects of an earthquake could be adverse for those who move to the area in response to employment opportunities of project construction and/or operation. Such effects would be equivalent under all four project alternatives. On a local scale, there are no known active or potentially active faults that, if projected, would trend toward or through South VAFB. Therefore, there is little likelihood of

TABLE 2.3.1

COMPARATIVE SUMMARY OF IMPACTS
SPACE LAUNCH COMPLEX 7
PROPOSED ACTION AND ALTERNATIVES

DISCIPLINE/RESOURCE	POTENTIAL EFFECT	ALTERNATIVE SITE			
		CYPRESS RIDGE	SLC-6	BOAT-HOUSE FLATS	VINA TERRACE
1. Geology and Soils	• Earthquake	Ø	Ø	Ø	Ø
	• Landslide	◐	⊗	○	●
	• Erosion	◐	⊗	○	●
	• Soil losses				
	- Construction	◐	○	⊗	●
	- Operations	◐	⊗	○	●
	• Excavation	◐	○	⊗	●
	• Fill	●	○	◐	○
	• Borrow site(s)	●	○	◐	○
	• Spoil site(s)	◐	○	⊗	●
2. Water Resources					
• Ground Water	• Water Use	Ø	Ø	Ø	Ø
• Surface Water	• Increased runoff	◐	○	⊗	●
	• Contamination from spill	Ø	Ø	Ø	Ø
3. Vegetation	• Loss of habitat	⊗	○	●	◐
	• Loss of sensitive species	●	○	◐	⊗
	• Operational deposition	◐	⊗	○	●
4. Wildlife					
• Channel Islands birds, mammals	• Launch noise, sonic boom	Ø	Ø	Ø	Ø
• Nearshore marine birds, mammals	• Construction/operations disturbance	⊗	⊗	●	○
	• Use of External Tank Landing Facility	Ø	Ø	Ø	Ø
	• Air Emissions	◐	◐	●	○
• Terrestrial birds, wildlife	• Loss of habitat, roosting sites	⊗	○	◐	●
	• Launch noise, sonic boom	Ø	Ø	Ø	Ø
	• Air emissions	Ø	Ø	Ø	Ø

Legend
○ = Least impact compared to other three sites
⊗ = Low intermediate impact compared to other three sites
◐ = High intermediate impact compared to other three sites
● = Most impact compared to other three sites
Ø = Same impact

TABLE 2.3.1 (Continued)

COMPARATIVE SUMMARY OF IMPACTS
SPACE LAUNCH COMPLEX 7
PROPOSED ACTION AND ALTERNATIVES

DISCIPLINE/RESOURCE	POTENTIAL EFFECT	ALTERNATIVE SITE			
		CYPRESS RIDGE	SLC-6	BOATHOUSE FLATS	VINA TERRACE
5. Air Quality/Meteorology	• Facility construction dust	◐	○	⊗	●
	• Pre-launch and post-launch processing emissions	Ø	Ø	Ø	Ø
	• Launch emissions	Ø	Ø	Ø	Ø
	• Vehicle failure emissions	Ø	Ø	Ø	Ø
6. Waste Management					
• Domestic Waste	• Santa Maria sewage treatment facility	Ø	Ø	Ø	Ø
• Industrial Waste	• Construction				
	- North VAFB Class III landfill	Ø	●	Ø	Ø
	- Lompoc Class II landfill	Ø	●	Ø	Ø
	• Operations				
	- North VAFB Class III landfill	Ø	Ø	Ø	Ø
	- Lompoc Class II landfill	Ø	Ø	Ø	Ø
• Hazardous Waste	• North VAFB hazardous waste storage facility				
	- Construction	Ø	●	Ø	Ø
	- Operations	Ø	Ø	Ø	Ø
	• Class I landfill				
	- Construction	Ø	●	Ø	Ø
	- Operations	Ø	Ø	Ø	Ø
7. Noise	• Normal launch	Ø	Ø	Ø	Ø
	• Explosion	Ø	Ø	Ø	Ø
8. Visual Resources	• Impair view from Jalama Beach	⊗	○	◐	●
	• Impair view from railroad	◐	○	●	⊗

Legend
○ = Least impact compared to other three sites
⊗ = Low intermediate impact compared to other three sites
◐ = High intermediate impact compared to other three sites
● = Most impact compared to other three sites
Ø = Same impact

TABLE 2.3.1 (Continued)

COMPARATIVE SUMMARY OF IMPACTS
SPACE LAUNCH COMPLEX 7
PROPOSED ACTION AND ALTERNATIVES

DISCIPLINE/RESOURCE	POTENTIAL EFFECT	ALTERNATIVE SITE			
		CYPRESS RIDGE	SLC-6	BOATHOUSE FLATS	VINA TERRACE
9. Cultural Resources					
• U.S. Coast Guard Rescue Station	• Disturbance from normal launch	◐	○	●	⊗
	• Vibration and emissions	◐	○	●	⊗
• Rock Art Site	• Vibration and emissions	⊗	●	○	◐
	• Disturbance from explosion	⊗	●	○	◐
• Archaeological Resources	• Disturbance from grading and earthmoving	●	○	◐	⊗
• Paleontology	• Disturbance from grading and earthmoving	◐	○	●	⊗
• Caliche Fossils	• Vibration from sonic boom	Ø	Ø	Ø	Ø
10. Transportation	• Increase in traffic	Ø	○	Ø	Ø
	• Need for additional traffic control	Ø	○	Ø	Ø
11. Health and Safety	• Normal launch	Ø	Ø	Ø	Ø
	• Unscheduled event	Ø	Ø	Ø	Ø
	• Explosion damage	◐	⊗	●	○
	• Fire damage	◐	⊗	○	●
12. Socioeconomics	• Construction				
	- Increased employment	Ø*	○*	Ø*	Ø*
	- Increased population	Ø	○	Ø	Ø
	- Increased housing demand	Ø	○	Ø	Ø
	- Increased demand to public services/utilities	Ø	○	Ø	Ø
	- Increased local/regional spending	Ø*	○*	Ø*	Ø*
	• Operations				
	- Increased employment	Ø*	Ø*	Ø*	Ø*
	- Increased population	Ø	Ø	Ø	Ø
	- Increased housing demand	Ø	Ø	Ø	Ø
	- Increased demand to public services/utilities	Ø	Ø	Ø	Ø
	- Increased local/regional spending	Ø*	Ø*	Ø*	Ø*

<u>Legend</u>

○ = Least impact compared to other three sites
⊗ = Low intermediate impact compared to other three sites
◐ = High intermediate impact compared to other three sites
● = Most impact compared to other three sites
Ø = Same impact
* = Positive/beneficial impact

TABLE 2.3.1 (Continued)

COMPARATIVE SUMMARY OF IMPACTS
SPACE LAUNCH COMPLEX 7
PROPOSED ACTION AND ALTERNATIVES

DISCIPLINE/RESOURCE	POTENTIAL EFFECT	ALTERNATIVE SITE			
		CYPRESS RIDGE	SLC-6	BOATHOUSE FLATS	VINA TERRACE
13. Land Use	• Interference to adjacent/nearby uses	Ø	Ø	Ø	Ø
	• New development area	⊗	○	◐	●
	• Coastal zone management	◐	○	●	⊗
14. Recreation	• Jalama Beach closures	Ø	Ø	Ø	Ø
	• Marine recreation interruptions	Ø	Ø	Ø	Ø

Legend
○ = Least impact compared to other three sites
⊗ = Low intermediate impact compared to other three sites
◐ = High intermediate impact compared to other three sites
● = Most impact compared to other three sites
Ø = Same impact

surface rupture. However, in the event of a major regional earthquake, ground motion would be experienced at the project site. The potential effect would be equivalent at the four potential sites. In order to decrease the susceptibility to damage from seismic activity, structures would be designed as specified in USAF Manual 88-3, Chapter 13, Seismic Design for Buildings. Also, containment systems would be designed to contain spills from tanks or piping that might be damaged as a result of earthquake activity.

There is minimal potential for naturally induced landsliding, as slopes in the area have been stable for the past several hundred years. However, failure of cut or fill slopes could result in potential significant impacts to adjacent facilities and structures. The likelihood of such occurrence is least at Boathouse Flats, as this is the flattest of the four sites. The primary potential for earth movement at this site relates to its proximity to the coastal bluff, as wave undercutting is producing ongoing retreat of the 40-foot sea cliff. However, the site boundary has been located 100 to 250 feet from land's edge, so no impact is expected. The potential for landsliding at SLC-6 is very low since construction earth moving took place prior to 1970 and slopes that have been disturbed have been stable to date. In addition, no excavation activities would take place at SLC-6. The potential for landsliding at the Cypress Ridge and Vina Terrace sites would be minimized by incorporating the results of geotechnical investigations into the facility design and grading plan. The Vina Terrace site is considered to be slightly more susceptible than Cypress Ridge to impacts resulting from slope instability, as this site has the greatest requirements for site alteration due to its steep terrain.

The potential for erosion at the four sites would be minimized by incorporating the results of geotechnical investigations into the design plans, which would provide for temporary utilization of erosion control material and/or paving subsequent to initial grading, rain runoff retention basins, controlled site drainage, and revegetation, as appropriate. During operations, an erosion control maintenance plan would provide measures so that storm water runoff, deluge water, and washdown water would not contribute to erosion potential. The Boathouse Flats site has the least potential for erosion, as it is relatively flat and is bordered on three sides by relatively flat terrain. The Vina Terrace site has the greatest potential for erosion, as it consists of such steep terrain that the entire project site would be created by excavating approximately 10 million cubic yards (CY) of material. The proposed Cypress Ridge and SLC-6 sites would have intermediate erosion potential, since each is sited on a relatively flat portion bordered by moderately sloping terrain. Of the two, Cypress Ridge has somewhat greater erosion potential.

Construction of SLC-7 would have the potential to increase soil losses in the local area. The potential for increased soil losses would be greater during construction than operations, due to the

amount of exposed bare soil, especially during grading. Based on annual rainfall, soil losses from storm runoff could be locally significant during construction, with estimates ranging from 750 to more than 5,000 tons of soil per year at the three undeveloped sites. The potential for increased soil loss at the SLC-6 alternative site during construction would be minimal since no excavation is planned. Impacts during operations would be considerably less than construction, ranging from 3 to 75 tons per year at the four sites. The amount of soil loss at the four sites for the construction phase, from least to most soil lost, would be at SLC-6, Boathouse Flats, Cypress Ridge, and Vina Terrace. The amount of soil loss at the four sites for the operations phase, from least to most, would be at Boathouse Flats, SLC-6, Cypress Ridge, and Vina Terrace.

Excavation would be greatest at the Vina Terrace site (about 10 million CY), intermediate at the Cypress Ridge (about 1.5 million CY) and Boathouse Flats sites (about 0.6 million CY), and least at the SLC-6 site, where no excavation is required. The requirements for fill are expected to be greatest for the Cypress Ridge site (about 1.5 million CY), intermediate for the Boathouse Flats site (about 0.4 million CY), and least for the SLC-6 and Vina Terrace sites, where no requirement for fill is anticipated. Based on anticipated differences between the amount of cut material and the requirements for fill, associated impacts to borrow sites are anticipated to be least for the SLC-6 and Vina Terrace sites, intermediate for the Boathouse Flats site, and greatest for the Cypress Ridge site. The same criteria indicate that impacts to spoil sites would be least for the Cypress Ridge site, intermediate for Boathouse Flats, and greatest for SLC-6 and Vina Terrace.

2.3.2 WATER RESOURCES

Regional impacts to ground water would occur based on increased use resulting from the proposed action. Such use primarily would occur from domestic requirements of project construction and operations households. Due to existing conditions of ground water overdraft within the region, specifically the Lompoc Plain, Lompoc Upland, and Santa Maria ground water basins, an increase in withdrawal would be expected to accelerate the depletion of storage, thereby being significant. Local impacts to ground water would occur based on onsite requirements of the facility and its operations personnel. Annual requirements would be approximately 380 acre-feet per year during project construction and about 45 acre-feet per year during operations. Based on data from development of the Space Shuttle at SLC-6, construction demands are not expected to have a long-term effect on the local ground water supply. Current demand of the Lompoc Terrace ground water basin, which provides water to South VAFB, is 260

acre-feet per year. The projected 17 percent increase resulting from implementation of SLC-7 would result in an overdraft of the South VAFB water supply system. The potential impacts to regional and local water use would be the same for any one of the four alternatives.

The proposed action would not affect surface water on a regional scale. On a local basis, project development is expected to result in an insignificant localized increase in runoff, as paving and compaction decrease infiltration at the project site. Runoff from the launch deck area would be contained in order to control potential contamination from launches or spills. Potential spills from holding tanks within the site would be contained by holding areas designed to prevent mixing with storm water runoff or other spillage. Containment at the four sites would be equally effective.

2.3.3 VEGETATION

Impacts to vegetation would consist primarily of removal and alteration of vegetation at the project site during construction and the potential for disturbance from project-related emissions during operations. Regional impacts are not anticipated. Construction impacts would result from the removal of vegetation necessary to accommodate site grading and other surface disturbances. The relative significance of impacts would depend on the actual amount and type of vegetation removed, as well as effects to special interest plants. Based on these criteria, the order of least to greatest impact would be: SLC-6, Boathouse Flats, Cypress Ridge, and Vina Terrace.

The SLC-6 alternative would involve the least disturbance to vegetation since no grading or excavation is required, and activities would take place in previously disturbed areas. The Boathouse Flats alternative would have an intermediate impact to vegetation in terms of total acreage (approximately 219 acres), but much of this (approximately 130 acres) would be nonnative grassland used primarily for grazing. In addition, there would not be a locally significant loss of monardella with implementation of this alternative. Impacts to about four acres of wetlands and two acres of willow-dominated riparian habitat would be minimized to the extent possible by avoidance. The potential loss of 40 to 50 monardella along the power line corridor would also be minimized with effective siting of power poles.

Of the three undeveloped sites, development of Cypress Ridge would disturb the least total acreage (± 185 acres), primarily Central and Venturan coastal scrub. However, it also would involve the loss of 800 to 1,000 mature individuals of *Monardella undulata* var. *frutescens*, a federal candidate species, an impact that could be minimized by revegetation. Potential disturbance to wetlands and willow-dominated riparian habitat would be the same as for the Boathouse Flats alternative.

Construction of the Vina Terrace alternative would have the greatest relative impact, since it would disturb the greatest total acreage (approximately 253 acres). However, it would not involve disturbance to special interest plants or wetlands.

Impacts from project operations would occur primarily during launches as a result of acidic deposition of HCl formed by contact of the deluge water with exhaust components of the SRMUs. Impacts could include damage to sensitive species, change in vegetation cover type, soil erosion from loss of vegetative cover, and loss of special interest plants. Vegetation within a downwind distance of approximately three miles may be affected to some extent by deposition. Due to the locations of the four alternative sites and the southeasterly direction of the ground cloud, the potential for such impacts would depend on the amount of land to receive such deposition. Therefore, there would be least impact from operations at the Boathouse Flats site, as the launch exhaust would be blown more over water than over land. There would be the greatest potential impact from the Vina Terrace alternative, due to its inland location. The intermediate impact related to acidic deposition would be expected to occur with operations at the SLC-6 and Cypress Ridge sites, being somewhat greater for Cypress Ridge.

2.3.4 WILDLIFE

Most of the impact to regional wildlife would be related to project operations, consisting primarily of potential effects of launch noise and focused sonic boom overpressure to marine birds and mammals on and in the vicinity of the northern Channel Islands, especially San Miguel Island. Launch-related sonic booms could result in temporary hearing impairment and could produce startle responses in certain marine birds and mammals. Construction and other operational impacts would be localized and not extend to the offshore/Channel Islands region. The alternate SLC-6, Boathouse Flats, and Vina Terrace sites are proximal (within one mile) of the proposed Cypress Ridge site. Therefore, the sonic overpressures, launch-related noise, and other operations impacts would be the same for the four sites.

Marine birds would experience short-term, localized, and insignificant impacts from the effects of launch noise and sonic booms, primarily temporary hearing impairment for those within a radius of about three to five miles. Such effects could be experienced by marine birds nesting in the area from Rocky Point to Point Pedernales, but are not expected to result in colony abandonment. Impacts to the California least tern nesting colonies at the mouth of the Santa Ynez River and at

Purisima Point are expected to be minimal. The effects of focused sonic booms also are not expected to be significant, although minor egg losses may occur to nesting colonies on San Miguel Island. The effects would be the same from the four alternatives.

The primary effects on marine mammals are anticipated to be minor, short-term hearing loss and/or startle responses that could result in the mammals running to water. These would be temporary and are not expected to be significant. Among the four pinniped species that breed on San Miguel Island (California sea lion, Harbor seal, Northern fur seal, and Guadalupe fur seal), the nature of the startle response would probably differ among each of the species. However, none is expected to abandon favored hauling sites or experience mother-pup separation. Due to the infrequent occurrence of sea otters, marine turtles, or the gray whale within the impact area, they are not expected to experience adverse impacts.

The primary impact to local biota would result from the potential ongoing effects of normal construction and operational activities, as well as intermittent impacts from launch noise and sonic booms. Construction impacts would result from: (1) removal of vegetation and (2) degradation of habitat from air pollution, noise, nearby human activity, and/or intrusion. Removal of vegetation would not result in significant impacts, as the vegetation involved is widespread on VAFB, supports wildlife species that tend to be locally common and wide-ranging, and is not known to support resident populations of threatened or endangered species. Noise, increased human activity, and exhaust emissions from heavy equipment and other construction vehicles would result in adjacent habitats being temporarily unattractive. An increase in road kills of wildlife would be expected due to increased vehicle traffic. These impacts are expected to be short-term and localized.

During operations, potential local impacts could occur from launch-related occurrences such as: (1) air pollutant emissions, (2) vehicle failure, and (3) launch noise and sonic booms. Air pollutant emissions from vehicle launch may result in insignificant, short-term, and localized impacts to terrestrial fauna. Most birds and ground animals would be frightened away by the noise, and there would be rapid attenuation of air emissions. Water used during launch and other activities would be contained and treated. Therefore, significant impacts are not expected. The known federal- or state-listed wildlife species in the vicinity are transient and migrant, such as the ferruginous hawk, peregrine falcon, brown pelican, and California least tern. Regionally rare and declining animals known to occur in the study area include the Northern harrier, prairie falcon, burrowing owl, least Bell's vireo, Wilson's warbler, and badger. These could be subject to localized, short-term impacts from exposure to air emissions.

Vehicle failure and explosion on the launch pad would have the potential to kill animals in habitats adjacent to the launch site. Such effects are expected to be insignificant, however, as: (1) the Titan 34D explosion in April 1986 did not result in observable impacts to biota in the vicinity of the SLC-4 launch site, and (2) local habitats are adapted to naturally occurring wildfires. Noise from vehicle launch could result in temporary hearing impairment to terrestrial biota within a three- to five-mile radius. Most birds, however, are relatively insensitive to sounds below 100 Hz, so they would be unlikely to experience auditory damage from launch noise or sonic booms. These potential effects to terrestrial biota from operations would be the same for the four project sites.

Marine birds utilizing the local environment could be affected during project construction by air pollution, noise, human activity, and intrusion into offsite areas adjacent to known marine bird nesting or roosting sites. There could be localized, short-term impacts to marine bird nesting and roosting colonies between Point Arguello and the Boathouse, or to those feeding in the offshore waters due to launch or accident-related ground clouds or propellant entering the water from an accidental release. The extent of such impact would depend on the sensitivity of the affected area and the rate of pollutant dispersion. There also could be disruption due to periodic use of the External Tank Landing Facility for barge delivery of project components. These potential impacts would be short-term, intermittent, and localized. There would be overall differences, however, depending on the chosen alternative. The greatest impact would occur with development and use of the Boathouse Flats site, due to its proximity to the shoreline. The least impact would occur with the Vina Terrace alternative, due to its relative distance from marine bird nesting, roosting, and foraging areas. The intermediate impacts would occur at the Cypress Ridge and SLC-6 sites. The effect of operations at the landing facility would be the same for operations at the four sites.

Marine mammals could be affected by near-shore construction activities, as well as vessel use of the near-shore and External Tank Landing Facility. They also could be affected by potential spills, launch-related ground clouds, and accidental propellant release. Pinnipeds hauled out along the shoreline could be affected by launch noise, potentially resulting in a startle response and running to water. The effects of launch complex construction and operations activities would be greatest at the Boathouse Flats site, due to its proximity to hauling areas and the potential for near-shore activities. The least impact would occur with the Vina Terrace alternative, due to its distance from the shore. Intermediate impacts would result from development at the Cypress Ridge and SLC-6 sites.

2.3.5 AIR QUALITY

Regional air quality is not anticipated to be significantly affected by implementation of the proposed action, as the impact resulting from construction and operation of SLC-7 is anticipated to be primarily localized. Both recent and historic studies indicate that VAFB contributes one to two percent to recorded regional emissions. There is the potential for regional dispersal of nitrogen oxides (NO_x) and other contaminants prior to and during launch of the Titan IV/Centaur. However, previous studies indicate that these activities would not measurably affect the VAFB contribution to regional air emissions.

It is expected that implementation of the proposed action would result in localized impacts from: (1) facility construction, (2) pre-launch and post-launch processing, (3) vehicle launch, and (4) vehicle failure. Facility construction would generate dust, primarily during demolition at the SLC-6 site and grading and other earth moving activities at the three undeveloped sites. These activities are anticipated to occur over a period of about one year. The entire construction period is anticipated to be about four years. Present estimates anticipate that approximately 250 tons of particulate material (controlled emissions) could be generated during a worst-case year of construction activity. Construction plans include a watering program to reduce dust emissions. Based on both the estimated area of disturbance and the amounts of cut and fill for the three undeveloped sites, the greatest impact to air quality from facility construction would occur with the Vina Terrace alternative, while the least impact would occur with the Boathouse Flats alternative. The intermediate impact would occur at the proposed Cypress Ridge site. Refurbishment of the SLC-6 site would result in generation of dust at levels significantly less than at the undeveloped sites (4 tons).

Under normal operational conditions, pre-launch and post-launch processing activities would result in minor emissions of fuel and oxidizer vapors, plus combustion products such as CO, SO_x, NO_x, PM_{10}, and HC. These emissions would be minor and infrequent and, therefore, insignificant. The potential impact from these and other operational activities would be the same for the four sites.

The greatest source of emissions to the atmosphere would be vehicle launch, which would result in emissions associated with oxidation of the propellants along the trajectory of the launch from liftoff to the shutdown of Stage II. The primary pollutant products would be HCl and Al_2O_3 from

combustion of the SRMUs, and CO and NO_x from combustion of hypergolic fuels. Standard VAFB launch operational control procedures restrict launches which would result in migration of pollutants into inland uncontrolled areas near VAFB.

There is the potential for vehicle failure, which would produce air pollutants that would be chemically similar to those produced during a normal launch, but in undetermined quantities and concentrations. Vehicle failure on the launch pad could result in an increase in ambient NO_x concentrations. Other vehicle incidents (in-flight failure, command vehicle destruction) would occur at some vertical distance, so dilution would occur prior to detection at ground level. The potential for vehicle failure would be the same for the four sites.

2.3.6 WASTE MANAGEMENT

Wastes generated by the proposed action can be classified as domestic, industrial, and hazardous, and they would be generated during the various activities associated with project construction and operations. Chemical toilets would be utilized for domestic waste generated during construction, with disposal at the Santa Maria treatment facility. For project operations, a new package sanitary sewage treatment plant would be utilized, with the sludge disposed of at the Santa Maria facility. An average of about 500 gallons per year would be added to the 6.5 million gallon per day (gpd) Santa Maria facility, which is operating at about 5.7 million gpd. The same amount of domestic waste would be generated at any one of the four project sites.

Industrial waste generated during construction would consist of materials such as metal, concrete, lumber, and other building materials which would be disposed of at an approved Class III or Class II landfill. During project construction, the greatest amount would be generated from demolition activities at SLC-6, estimated to be about 1,200 tons of metal and 1,800 cubic yards of concrete. The three undeveloped sites would generate much less industrial waste during construction. Industrial waste generated during operations would include small amounts of solid wastes and large amounts of liquid wastes. The solid wastes would be disposed of at either the North VAFB Class III landfill or a Class II landfill. The liquid wastes would be treated at facilities on South VAFB according to requirements of the RWQCB and would not impact the regional environment. Two treatment alternatives are being considered: (1) conveying the water to the SLC-6 wastewater treatment plant for treatment using a precipitation/filtration and reverse osmosis process, or (2) for the alternatives excepting SLC-6, utilizing a new facility, to be constructed at the project site. The generation and treatment of industrial waste during operations would be the same for the four potential sites.

Hazardous wastes generated during project construction would consist of materials such as waste oils, hydraulic, cleaning and cutting fluids, and waste antifreeze. These materials would be containerized, transferred to the South VAFB collection accumulation point (CAP) at SLC-6, then transferred to the EPA-permitted RCRA hazardous waste storage facility on North VAFB for recycle or disposal at a Class I landfill. The North VAFB facility has a capacity of 45,760 gallons and stored an average of 15,400 gallons in 1987. The wastes generated during SLC-7 construction would increase the utilization of the facility, but would not have a significant impact.

Modification of SLC-6 would require the decontamination and removal of some existing hypergolic fuel and oxidizer delivery lines. This activity would generate approximately 82,000 gallons of liquid hazardous waste. This waste would be disposed of at an appropriate treatment facility.

Disposal at a Class I landfill would reduce the overall life of the landfill incrementally. During project operations, hazardous wastes generated would consist primarily of water contaminated by hypergolic fuel, plus various solvents and cleaners, paints and primers, cleaning rags, and contaminated clothing. These wastes would be generated from activities at the South VAFB project site, in Buildings 8337 and 8401, and at other maintenance facilities on North VAFB.

It is estimated that SLC-7 operations would increase by 11 percent the amount of hazardous waste generated at VAFB. This increase would not be expected to adversely affect the VAFB hazardous waste storage facility. It would increase its utilization, but to less than one-half of its total capacity. Effects to the Class I landfill utilized for disposal would be incremental and would, to some extent, decrease the life of that facility. Impacts are not expected to be significant.

Waste generation and management would be project-specific rather than site-specific, so the choice of site for project implementation is not expected to have a noticeable affect. Therefore, impacts related to operations would be the same for the project at any of the four sites being evaluated.

2.3.7 NOISE

Regional noise impacts would occur from normal launch events and could occur from an unscheduled event such as an explosion. Normal launch is expected to result in noise levels of approximately 100 dBA at Lompoc and 90 dBA at Santa Maria, which would persist for about 60 seconds for a maximum of three launches per year. An explosion during liftoff could create a short-duration noise, which could easily be heard in Lompoc. Due to intervening topography, an on-pad explosion could result in a noise level of approximately 90 dBA at Lompoc, attenuating to a potentially discernible 80 dBA at Santa Maria. Due to its relatively short duration of a few seconds, such noise might be an annoyance, but would not be significant. Both scenarios would result in noise events considerably below the EPA maximum worker exposure level of 115 dBA for 15 minutes. Therefore, significant impacts are not anticipated. These potential noise events would be the same for the four sites.

At a local level, normal operations would result in noise levels similar to other industrial sites on VAFB. Noise produced by a normal launch or an unscheduled event such as an explosion would create significant noise levels at the launch deck, anticipated to be about 170 dBA for launch and about 200 dBA for an explosion. These noise levels would be locally significant, requiring appropriate mitigation measures. During launch, personnel would be restricted from areas that would experience the greatest noise levels, and personnel stationed nearby, but outside of the launch safety area, would be required to wear hearing protection, as necessary. Noise impacts from an unscheduled event such as an explosion could be locally significant, depending on the location and preparedness of personnel in the area. These impacts would be the same for the four potential sites.

A launch-induced sonic boom would occur over water, several miles down range in the launch azimuth. Therefore, resulting noise would not affect areas of human population, but could affect Channel Islands wildlife. These potential effects are addressed in Section 2.3.4, Wildlife.

2.3.8 VISUAL RESOURCES

Impacts to the existing visual character of the project site would occur as a result of changing from its current use to the proposed space launch complex use. The impacts would differ markedly, depending upon whether SLC-6 or one of the undeveloped sites is chosen for implementation of the proposed action. In general, the visual impact resulting from use of the SLC-6 site would not be discernible. Conversion of SLC-6 from its configuration for the Space Shuttle to a

configuration for the Titan IV/Centaur would involve changes to ground level facilities and interior configurations, elements which are not discernible from views available to the public. The on-pad presence of the space vehicle might be noticed by the public, but would not be a significant visual element. Therefore, there would be no visual impact from implementation of SLC-6 for the proposed action.

Use of one of the three undeveloped sites would have visual impacts, however, resulting from conversion of the site from undeveloped open space to an active, industrial-type use. Therefore, further discussion compares the impacts of project development at the proposed Cypress Ridge site and Boathouse Flats and Vina Terrace alternatives. From a regional perspective, views of the completed project at one of the undeveloped sites would be available from marine and railroad traffic and from the vicinity of Jalama Beach County Park. This would not be considered significant, however, due to the distance and context from which limited views are available. Further, although the project would change the undeveloped character of the coastline south of Point Arguello, it would not be a regionally significant part of the landscape and would not obstruct public views of the coastline. On a regional basis, the most sensitive public view would be from Jalama Beach. From this perspective, the greatest impact would occur with the implementation of the Vina Terrace alternative, as the major structures would be visible against the skyline. Also, the extensive excavation that would be required, plus the extensive access roadway, would make the site visually prominent, even without the space launch facilities. The proposed Cypress Ridge alternative would have the least impact, as it would be backed by topography extending above the height of the major facilities, which would reduce its visual prominence. The Boathouse Flats alternative would have an intermediate impact. There would not be extensive cut to mar an adjacent hillside, but its location within a relatively large, flat area on a promontory adjacent to the shoreline would result in the major structures standing out against the skyline.

Local public views of the site from occasional marine and daily train traffic would vary, depending on the observation point. When viewed from nearby locations, the project could be a dominant visual feature due to its scale and contrast. The extent of impact would vary, depending on the selected alternative. On a local basis, the most sensitive public view would be from passengers traveling though South VAFB by train. From here, the greatest impact would occur with the Boathouse Flats alternative, as this would provide the nearest perspective to the train and, given the relatively flat terrain of the Boathouse Flats area, the space launch complex would be in sharp contrast and scale to the natural surroundings. Further, significant views of the coastline from the railroad would be interrupted by the constructed facility at this location. The least impact would occur with the Vina Terrace alternative, due to its elevation and distance from the railroad. The

intermediate effect would occur with the proposed Cypress Ridge alternative, being the median distance from the railroad. Due to the context in which such views would be available, and the limited number of persons involved, these impacts are considered insignificant.

2.3.9 CULTURAL RESOURCES

Because of the nature of the potential effects of project construction and operation, regional impacts to historic and prehistoric cultural resources are not anticipated. However, the caliche plant fossils on San Miguel Island may be affected by the shock from sonic booms associated with space vehicle launches. Such events could cause some of the fragile fossils to break, thereby accelerating the ongoing natural and inevitable deterioration process. Such impact would be significant in the short term but insignificant in the long term and would be the same for the four sites.

Within the environmental study area, there may be effects to the historic former U.S. Coast Guard Rescue Station and to archaeological sites, which preliminary studies indicate may be eligible for inclusion in the National Register. The one historic property within the local area is the former Point Arguello U.S. Coast Guard Rescue Station (Boathouse), located in the vicinity of the Boathouse Flats site. The structures here could be affected, primarily by noise-induced vibrations and air emissions associated with normal vehicle launches and unscheduled events, such as an explosion. The potential impact would be greatest with the Boathouse Flats alternative, due to its proximity, and least with SLC-6, due to its relative distance. The effects of operations at the Cypress Ridge and Vina Terrace sites would be intermediate, being greater relative to Cypress Ridge.

The prehistoric rock art site located northeast of the SLC-6 site also could be affected, primarily by vibration and emissions associated with normal vehicle launch and unscheduled events. The primary factor would be proximity to the site. Therefore, the greatest impact would be expected to occur from activities at SLC-6, while the least effect would be from the Boathouse Flats site. Project operations at Vina Terrace and Cypress Ridge, would have an intermediate impact, being somewhat greater relative to Vina Terrace.

Disturbance to archaeological resources would occur as a result of disturbance to subsurface deposits from both grading and trenching activities. Based on results of surface and subsurface investigations performed to date, the greatest impact would occur with development of the proposed Cypress Ridge site and associated utility and communications lines. The least impact would be expected to occur with project implementation at the SLC-6 site, since no earth moving

or excavation is anticipated for this alternative. The next least impact would occur at the Vina Terrace site, as it is an area with little archaeological potential, due to its steep terrain and distance from the ocean. Intermediate impacts would occur with development of the Boathouse Flats site. Most archaeological resources at this site are located on or near the southern and western edges of the potential construction area.

Impacts to the Manzanita Road borrow site would depend on the extent of disturbance, which could affect intact deposits in previously undisturbed areas. The potential effect would likely depend on the amount of material taken. Based on the amount of fill necessary for development of the proposed and alternative sites, the greatest potential impact would occur with the proposed Cypress Ridge site. The least impacts would result from implementation of the Vina Terrace and SLC-6 alternatives, which would not require fill. The intermediate impacts would be associated with the Boathouse Flats alternative.

The activities of road construction, grading, and trenching could affect paleontological resources within the study area. The extent of potential effect depends on the extent of disturbance and the underlying soil type. The greatest potential effect could occur at the Boathouse Flats site, which is underlain by lower terrace deposits that are regionally recognized as yielding significant fossil remains. The least impact would occur at the SLC-6 site since no excavation is anticipated. The low intermediate impact would occur at the Vina Terrace site. Here, the potential for significant impacts is low due to the thin strata of the sediments and the rarity of significant resources in the shale. The potential for high intermediate impact would occur at the Cypress Ridge site.

2.3.10 TRANSPORTATION

Impacts to regional streets and highways would occur as a result of additional construction and operations workers who would move to the area in response to employment opportunities created by the proposed action. Other impacts could result from changes in driving patterns by persons already living in the area. Anticipated traffic increases during both construction and operations are expected to be minor relative to existing traffic levels and would not change levels of service on roads or at intersections. There could, however, be noticeable impacts to the Main Gate at VAFB, as the additional traffic could increase congestion during peak hours. This could exacerbate existing congestion, resulting in greater delays than currently exist. Traffic at the South Gate of VAFB also could begin experiencing delays with the addition of SLC-7 traffic. Such impacts would be the same for the four potential sites.

Potential impacts to transportation at South VAFB, particularly near the project area, would result from the increase in traffic during peak hours. This could lead to slower average speeds for vehicles on local roads. There also could be delays in entering the site area if all personnel arrived at about the same time. These impacts would be the same for the four alternatives.

2.3.11 HEALTH AND SAFETY

Impacts to human health and safety as a result of project construction and operations primarily would be related to the potential for accidents. A detailed discussion of potential impacts is contained in the SLC-7 Risk Assessment (Environmental Solutions 1989f). Impacts during construction are not anticipated, although their likelihood of occurrence is the same as with other, major industrial projects.

The aspects of normal operations with the greatest potential to affect human health and safety are those activities related to hypergolic propellant transportation/storage and/or transportation and preparation of Solid Rocket Motor Upgrade (SRMU) segments. Rupture of hypergolic storage vessels could result in the release of toxic gases to the atmosphere and the attendant possibility of explosion, with potential health and/or safety impacts. However, hypergolic propellants have been shipped to VAFB since 1958, with no major accidents. According to a 1981 study, the accident rate is approximately 1.56 per one million round-trip vehicle miles traveled between the Mississippi and Alabama processing plants and VAFB. An accident involving an SRMU segment could result in ignition of the propellant, with subsequent release of HCl, Al_2O_3, and heat. There would be the potential for adverse health and safety impacts from such an occurrence, as HCl gas can be toxic to humans and wildlife, Al_2O_3 dust can cause respiratory ailments, and the released heat could be damaging to equipment, humans, and wildlife.

Regional impacts related to normal launch operations could occur from the release of HCl and Al_2O_3. These are not expected to be significant due to USAF safety procedures which preclude a normal launch if a Toxic Hazard Corridor encompasses an uncontrolled, populated area. Accidents related to cryogenic propellants or stored propane could lead to explosion and/or fire, with attendant adverse impacts.

Effects of a launch anomaly would be similar to those of a normal launch, but potentially more severe. There would be a ground cloud, as with a normal launch, but it could contain hypergolic propellant residues. There also would be the possibility of explosion and fire and resultant damage, depending on the severity of the incident.

The potential for an accident that could result in health and safety impacts would be the same for the four sites. However, the extent of impact could vary by site. For example, a fire to the area outside the launch complex could be most difficult to contain at the Vina Terrace site, due to its steep terrain and relative inaccessibility. The least difficulty would be expected at the Boathouse Flats site, with the Cypress Ridge and SLC-6 sites being intermediate. Also, damage from explosion could be considered more severe at the Boathouse Flats site due to the proximity of historic structures and the External Tank Landing Facility. Potential for impacts to humans at these facilities would be greatest with an explosion emanating from the Boathouse Flats site and least from Vina Terrace. The potential impacts from Cypress Ridge and SLC-6 would be intermediate.

2.3.12 SOCIOECONOMICS

The socioeconomic effects of the proposed action would be most noticeable in the nearby communities of Lompoc and Santa Maria and, to a lesser extent, within the greater Santa Barbara County area. The primary impact of the need for a maximum anticipated 550 construction workers and 400 operations personnel would create an increase in both direct and indirect employment opportunities. These increases in employment subsequently would lead to increases in population, housing demand, public services and utilities demand, and local and regional spending. It is anticipated that employment related to the proposed action would broaden the economic base of the area and augment the current offshore oil and gas development. In general, these effects are anticipated to be beneficial to the growing North County area. The socioeconomic impacts would be similar for the three undeveloped sites. Modification of the SLC-6 site would result in less economic benefit, as overall construction activity at SLC-6 is anticipated to be about 80 percent of activities at an undeveloped site.

2.3.13 LAND USE

Implementation of the proposed action would result in an increase in the number of times that offsite land use activities within the Range Safety Zone would be temporarily disrupted by launch events at VAFB. As planned, there would be a maximum of three launches per year from SLC-7 and six per year from other space launch complexes, beginning in 1994. Uses that could be disrupted would be offshore oil and gas extraction and commercial activities in the inner Santa Barbara Channel. These impacts would be short-term, lasting only until potential hazards associated with launch activities had passed. Implementation of the proposed housing development south of VAFB could result in residences being located within the launch Range

Safety Zone for operations at SLC-7 and other South VAFB space launch complexes. Therefore, the USAF has begun a detailed study to evaluate acquisition of potentially affected private lands near VAFB. The Bixby Ranch has been informed of these plans. Impacts to off-base land uses would be equivalent for the four potential sites.

The proposed action is consistent with VAFB land use plans and with other South VAFB land uses. However, the project would likely result in temporary disruption of existing offsite land uses that have encroached into the Range Safety Zone.

Of the four alternative sites, the three undeveloped sites are utilized for grazing, while SLC-6 is a developed launch site. If one of the undeveloped sites is chosen, approximately 185 to 250 acres would be removed from grazing use. Due to the relatively small size of these sites compared to the total area available for grazing on VAFB, the impact would not be significant. Overall, the least impact to grazing would be with use of the SLC-6 site. Of the three undeveloped sites, the proposed Cypress Ridge would have the least impact (approximately 185 acres). Vina Terrace would have the greatest impact (approximately 250 acres), and the Boathouse Flats site would be intermediate, utilizing approximately 220 acres.

2.3.14 RECREATION

The primary impact to recreation would be possible closures of Jalama Beach County Park and other public coastal beaches during launch events, anticipated to occur a maximum of three times per year. These closures would be in addition to those resulting from other launches from South VAFB. Offshore marine recreation also could be disrupted during launch events. Although inconvenient, such intermittent occurrences are not considered to be significant. These impacts would be the same for the four alternatives.

SECTION 2.4

SUMMARY OF CUMULATIVE IMPACTS

ENVIRONMENTAL CONSIDERATION	PROJECT SITE			
	CYPRESS RIDGE	SLC-6	BOATHOUSE FLATS	VINA TERRACE
2.4.1 Geology and Soils	1. No cumulative impacts are foreseen.	1. Same as Cypress Ridge.	1. Same as Cypress Ridge.	1. Same as Cypress Ridge.
2.4.2 Water Resources	1. No cumulative impacts to surface water are foreseen. 2. SLC-7 project operations would increase demand for potable water from South VAFB aquifer by approximately 45 acre-feet per year, a 17 percent increase over existing demand of other facilities on South VAFB. The SLC-7 water requirement is anticipated to result in overdraft of the Lompoc Terrace ground water basin. 3. Regional water use is estimated to increase about 14 percent by 1995, with SLC-7-related use comprising about one percent of that increase.	1. Cumulative impacts would be the same as Cypress Ridge 1-3.	1. Cumulative impacts would be the same as Cypress Ridge 1-3.	1. Cumulative impacts would be the same as Cypress Ridge 1-3.
2.4.3 Vegetation	1. The SLC-7 site at Cypress Ridge would add about 120 acres of disturbed terrestrial vegetation to the 425 acres comprised by the four existing launch complexes on South VAFB (SLC-3, SLC-4, SLC-5, SLC-6).	1. SLC-6 comprises a portion of the 425 acres disturbed by existing launch complexes on South VAFB. Its use would not add to the disturbance area.	1. The SLC-7 project at the Boathouse Flats location would add 130 acres to the 425 acres disturbed by the four existing launch complexes on South VAFB.	1. The SLC-7 project at the Vina Terrace location would add 150 acres to the 425 acres disturbed by the four existing launch complexes on South VAFB.
2.4.4 Wildlife	1. The proposed action, combined with others on South VAFB, would further reduce and fragment undisturbed local wildlife habitats and wildlife movement corridors.	1. No cumulative impact would be created by utilizing SLC-6.	1. Cumulative impacts would be the same as Cypress Ridge 1-2.	1. Cumulative impacts would be the same as Cypress Ridge 1-2.

SECTION 2.4

SUMMARY OF CUMULATIVE IMPACTS

ENVIRONMENTAL CONSIDERATION	PROJECT SITE			
	CYPRESS RIDGE	SLC-6	BOATHOUSE FLATS	VINA TERRACE
2.4.4 Wildlife - (Cont'd.)	2. SLC-7 would contribute to incremental losses of potential foraging habitat for peregrine falcons and other regionally rare or declining raptors on South VAFB.			
2.4.5 Air Resources	1. The proposed action would add approximately 10 percent to the total burden of emissions from the STS Power Plant and offshore oil platforms Harvest, Hidalgo, and Hermosa.	1. Cumulative impacts would be the same as Cypress Ridge.	1. Cumulative impacts would be the same as Cypress Ridge.	1. Cumulative impacts would be the same as Cypress Ridge.
2.4.6 Waste Management	1. Domestic waste sludge from SLC-7 would be added to that from SLC-4 which is disposed of at the city of Santa Maria sewage treatment plant. This is not a significant contribution to the facility's 6.5 million gpd capacity and 5.7 million gpd operating level. 2. Industrial solid wastes from SLC-7 would be added to those from SLC-3 and SLC-4 to be disposed of in an approved Class III or Class II landfill. The small amounts of wastes generated would contribute to an incremental decrease in the useful life of the utilized landfill.	1. Cumulative impacts would be the same as Cypress Ridge 1-4.	1. Cumulative impacts would be the same as Cypress Ridge 1-4.	1. Cumulative impacts would be the same as Cypress Ridge 1-4.

SECTION 2.4

SUMMARY OF CUMULATIVE IMPACTS

ENVIRONMENTAL CONSIDERATION	PROJECT SITE			
	CYPRESS RIDGE	SLC-6	BOATHOUSE FLATS	VINA TERRACE
2.4.6 Waste Management - (Cont'd.)	3. Industrial wastewater from SLC-7 would be added to that from SLC-3 and SLC-4 which is evaporated at the SLC-6 evaporation ponds. About 1.4 million gallons of water would be added to the 3.0 million gallon ponds each year. Normal evaporation would prevent overflow. 4. The hazardous wastes generated by the SLC-7 facility would add about 11 percent per year to VAFB hazardous waste generation and the amount being stored at the North VAFB waste storage facility. This increase would bring the facility to less than 50 percent of capacity. There also would be an incremental increase in wastes being disposed of at a utilized Class I landfill and a consequent decrease in the useful life of that facility.			
2.4.7 Noise	1. The potential addition of three launches per year from SLC-7 to the projected VAFB launch schedule could result in nuisance levels of launch noise in the Lompoc and Santa Maria areas occurring about nine times per year.	1. Cumulative impacts would be the same as Cypress Ridge.	1. Cumulative impacts would be the same as Cypress Ridge.	1. Cumulative impacts would be the same as Cypress Ridge.
2.4.8 Visual Resources	1. The proposed action would extend to the south the existing array of space launch complexes on South VAFB impinging on some viewsheds.	1. No cumulative impacts would be created by utilizing SLC-6.	1. Cumulative impacts would be the same as Cypress Ridge.	1. Cumulative impacts would be the same as Cypress Ridge.

SECTION 2.4

SUMMARY OF CUMULATIVE IMPACTS

ENVIRONMENTAL CONSIDERATION	PROJECT SITE			
	CYPRESS RIDGE	SLC-6	BOATHOUSE FLATS	VINA TERRACE
2.4.9 Cultural Resources	1. The proposed action would result in disturbance to South VAFB cultural resources, in addition to resources disturbed by construction of other space launch complexes on South VAFB. 2. To the extent that the caliche plant fossils on San Miguel Island are sensitive to overpressure and sonic boom, the addition of SLC-7 to the existing number of launches from South VAFB would increase their exposure to such events, thereby accelerating the existing, relatively rapid rate of deterioration.	1. No cumulative impacts would occur to archaeological resources as a result of utilizing SLC-6. 2. Cumulative impacts to other cultural resources would be the same as Cypress Ridge 2.	1. Cumulative impacts would be the same as Cypress Ridge 1-2.	1. Cumulative impacts would be the same as Cypress Ridge 1-2.
2.4.10 Transportation	1. Increases in traffic volumes are not expected to change existing levels of service for either the construction or operations phases of the SLC-7 project alone. 2. The activation of the Titan IV/NUS program at SLC-4 East could result in locally noticeable increases in traffic, depending on the number of workers involved and the phasing of activities with the SLC-7 project.	1. Cumulative impacts would be slightly less than Cypress Ridge during project construction. 2. Cumulative impacts related to project operations would be the same as Cypress Ridge 1-2.	1. Cumulative impacts would be the same as Cypress Ridge 1-2.	1. Cumulative impacts would be the same as Cypress Ridge 1-2.

SECTION 2.4

SUMMARY OF CUMULATIVE IMPACTS

ENVIRONMENTAL CONSIDERATION	PROJECT SITE			
	CYPRESS RIDGE	SLC-6	BOATHOUSE FLATS	VINA TERRACE
2.4.11 Health and Safety	1. The addition of three SLC-7 launches per year at VAFB would increase the opportunity for accidents related to propellant transport/transfer, SRMU transport/handling, and launch operations. 2. The potential for accidents would increase with activation of Titan IV operations at SLC-4 East, also located on South VAFB.	1. Cumulative impacts would be the same as Cypress Ridge 1-2.	1. Cumulative impacts would be the same as Cypress Ridge 1-2.	1. Cumulative impacts would be the same as Cypress Ridge 1-2.
2.4.12 Socioeconomics	1. Depending on the timing of SLC-7 construction compared to other, major projects in the north Santa Barbara County area, there could be a cumulative impact on the demand for construction workers and housing. 2. The project is expected to result in the addition of about 565 new families to the Lompoc-Santa Maria area, thereby adding to existing growth and the demand for housing and services. 3. It is estimated that the wage and salary contribution to the regional impact area would be about $9.4 million annually for the four-year construction period. 4. It is estimated that the annual economic contribution to the regional impact area would be about $8.3 million per year during facility operations, which would be designed for a minimum of 25 years.	1. Cumulative impacts would be the same as Cypress Ridge 1, 2, and 4. 2. It is estimated that the wage and salary contribution to the regional impact area would be about $5.2 million annually for the four-year construction period.	1. Cumulative impacts would be the same as Cypress Ridge 1-4.	1. Cumulative impacts would be the same as Cypress Ridge 1-4.

SECTION 2.4

SUMMARY OF CUMULATIVE IMPACTS

ENVIRONMENTAL CONSIDERATION	PROJECT SITE			
	CYPRESS RIDGE	SLC-6	BOATHOUSE FLATS	VINA TERRACE
2.4.13 Land Use	1. The project would add about 120-150 acres of developed land to the 425 acres currently occupied by the four existing South VAFB space launch complexes and extend industrial-type development further into existing open space and grazing areas. 2. Additional launches could impact potential use of the Bixby Ranch properties. Under independent action, the USAF is engaged in activities to acquire such lands that, under other ownership, could adversely affect the USAF mission at VAFB.	1. No cumulative impacts to South VAFB land use would result from utilizing SLC-6. 2. Cumulative impacts to land outside of South VAFB would be the same as Cypress Ridge 2.	1. Cumulative impacts would be the same as Cypress Ridge 1-2.	1. Cumulative impacts would be the same as Cypress Ridge 1-2.
2.4.14 Recreation	1. The project would result in closure of Jalama Beach during launch events. The proposed SLC-7 launches could result in three additional closures per year, in addition to the four to six projected to occur, beginning in 1994.	1. Cumulative impacts would be the same as Cypress Ridge.	1. Cumulative impacts would be the same as Cypress Ridge.	1. Cumulative impacts would be the same as Cypress Ridge.

SECTION 2.5

SUMMARY OF MITIGATION MEASURES

ENVIRONMENTAL CONSIDERATION	PROJECT SITE MITIGATION			
	CYPRESS RIDGE	SLC-6	BOATHOUSE FLATS	VINA TERRACE
2.5.1 Geology and Soils	1. Incorporate results of geotechnical investigations into facilities design and grading requirements. 2. Locate critical structures away from potential slide planes. 3. Provide surface drainage/ erosion control plan for project construction and operations. Include settling basins, energy dissipators, and/or flow dividers. 4. Utilize revegetation to reduce runoff.	1. Complete erosion control efforts begun on east boundary of site.	1. Same as Cypress Ridge Mitigation Measures 1-4.	1. Same as Cypress Ridge Mitigation Measures 1-4.
2.5.2 Water Resources	1. During construction, minimize surface runoff by revegetation, construction of temporary drainage devices, and other erosion control measures. 2. After construction, reclaim and revegetate disturbed areas. Establish permanent drainage and erosion control measures, in accordance with the restoration plan.	1. Same as Cypress Ridge Mitigation Measure 2.	1. Same as Cypress Ridge Mitigation Measures 1-2.	1. Same as Cypress Ridge Mitigation Measures 1-2.
2.5.3 Vegetation	1. Provide the opportunity for interested parties to recover specimens of special interest plants prior to construction. 2. Pre-plan construction activities to minimize the extent of disturbed land and avoid wetlands. 3. Limit construction vehicle travel to designated roads and staked areas.	1. Limit construction to previously disturbed areas. 2. Same as Cypress Ridge Mitigation Measures 5, 6, and 7.	1. Same as Cypress Ridge Mitigation Measures 1-7.	1. Same as Cypress Ridge Mitigation Measures 1-7.

SECTION 2.5

SUMMARY OF MITIGATION MEASURES

ENVIRONMENTAL CONSIDERATION	PROJECT SITE MITIGATION			
	CYPRESS RIDGE	SLC-6	BOATHOUSE FLATS	VINA TERRACE
2.5.3 Vegetation - (Cont'd.)	4. Stockpile the top six inches of topsoil for revegetation. 5. Utilize soil stabilization measures, such as erosion control material, soil cement, and/or gunite, especially on areas of steep slopes or highly erodible soils. 6. Appropriate environmental monitor will be present, as necessary, during clearing and grading activities. 7. Establish a monitoring program to assess operational air emissions impacts to vegetation, with an emphasis on sensitive species.			
2.5.4 Wildlife	1. Formulate and implement a construction and restoration plan to minimize loss of wildlife habitat. 2. Control offsite activity by construction and operations personnel. Restrict workers from unauthorized visits to sensitive wildlife areas such as harbor seal haul out grounds and marine bird roost sites and nesting colonies. 3. A qualified biologist will inspect construction activities periodically.	1. Same as Cypress Ridge Mitigation Measures 2, 3, 4, and 6.	1. Same as Cypress Ridge Mitigation Measures 1-6.	1. Same as Cypress Ridge Mitigation Measures 1-6.

SECTION 2.5

SUMMARY OF MITIGATION MEASURES

ENVIRONMENTAL CONSIDERATION	PROJECT SITE MITIGATION			
	CYPRESS RIDGE	SLC-6	BOATHOUSE FLATS	VINA TERRACE
2.5.4 Wildlife - (Cont'd.)	4. Employ proper procedures and equipment at the External Tank Landing Facility to minimize the opportunity for wildlife to be affected by spills, human interference, or other hazards. 5. Appropriate environmental monitor will be present, as necessary, during clearing and grading activities. 6. Establish a monitoring program to assess operational noise and air emissions impacts to wildlife, with an emphasis on listed species.			
2.5.5 Air Resources	1. During project construction, water the project site and other construction areas as necessary to minimize visible particulate emissions. Minimize emissions from construction equipment and vehicles by proper engine maintenance. 2. If necessary, modify ground disturbing activities to maintain opacity at or below recommended levels. 3. Launch events will occur only during periods of favorable meteorological conditions, based on a forecast Toxic Hazard Corridor prepared for each launch. 4. Install and maintain air pollution control equipment as necessary on project elements which emit air contaminants.	1. Same as Cypress Ridge Mitigation Measures 1-5.	1. Same as Cypress Ridge Mitigation Measures 1-5.	1. Same as Cypress Ridge Mitigation Measures 1-5.

SECTION 2.5

SUMMARY OF MITIGATION MEASURES

ENVIRONMENTAL CONSIDERATION	PROJECT SITE MITIGATION			
	CYPRESS RIDGE	SLC-6	BOATHOUSE FLATS	VINA TERRACE
2.5.5 Air Resources - (Cont'd.)	5. During construction, if required by SBCAPCD, activities may be curtailed in order to reduce emissions.			
2.5.6 Waste Management	1. Construction contractors would submit waste management plan that identifies the wastes to be generated during construction and their manner of handling and disposal. 2. Upgrade or replace existing evaporation ponds at SLC-6 in order to comply with new regulations, as necessary, to accept waste brine solution. 3. Use paints and primers with low metal content on structures which come into contact with deluge water. 4. If necessary, enlarge present or build new VAFB hazardous waste storage facilities.	1. Same as Cypress Ridge Mitigation Measures 1-4.	1. Same as Cypress Ridge Mitigation Measures 1-4.	1. Same as Cypress Ridge Mitigation Measures 1-4.
2.5.7 Noise	1. During launch events, exclude personnel from site areas exposed to the greatest noise levels. Provide hearing protection, as necessary.	1. Same as Cypress Ridge.	1. Same as Cypress Ridge.	1. Same as Cypress Ridge.
2.5.8 Visual Resources	1. Use low glare lights which are shielded from areas outside the perimeter of the launch complex, as appropriate.	1. Same as Cypress Ridge.	1. Same as Cypress Ridge.	1. Same as Cypress Ridge.

SECTION 2.5

SUMMARY OF MITIGATION MEASURES

ENVIRONMENTAL CONSIDERATION	PROJECT SITE MITIGATION			
	CYPRESS RIDGE	SLC-6	BOATHOUSE FLATS	VINA TERRACE
2.5.9 Cultural Resources	1. Avoidance is the preferred mitigation and will be utilized where feasible. 2. Implement data recovery procedures where avoidance is not feasible. 3. Qualified observers, including a Native American(s), will be present to monitor ground disturbing activities. 4. In general, design alignment of underground and aboveground utilities and access roads to avoid disturbance to known or suspected archaeological sites. 5. Mitigate potential impacts to the rock art site through pre-launch documentation and post-launch monitoring. 6. Limit movement of construction vehicles to staked areas. 7. Place power poles outside of intact archaeological sites, as feasible. 8. Design underground communications and utilities to avoid known or suspected site deposits as feasible. 9. Utilize qualified personnel to monitor for paleontological resources during earth moving activities.	1. Same as Cypress Ridge Mitigation Measures 3, 5, and 10.	1. Same as Cypress Ridge Mitigation Measures 1-10. 2. As feasible, avoid the archaeological site complex at Oil Well Canyon by project design. 3. Avoid areas along the bluff, as feasible.	1. Same as Cypress Ridge Mitigation Measures 1-10.

SECTION 2.5

SUMMARY OF MITIGATION MEASURES

ENVIRONMENTAL CONSIDERATION	PROJECT SITE MITIGATION			
	CYPRESS RIDGE	SLC-6	BOATHOUSE FLATS	VINA TERRACE
2.5.9 Cultural Resources - (Cont'd.)	10. Implement an accelerated maintenance program at the former U.S. Coast Guard Rescue Station (Boathouse).			
2.5.10 Transportation	1. Support USAF policy of encouraging car pooling and staggered work hours to diminish peak traffic.	1. Same as Cypress Ridge.	1. Same as Cypress Ridge.	1. Same as Cypress Ridge.
2.5.11 Health and Safety	1. No additional mitigation measures beyond established USAF procedures are proposed for Health and Safety issues.	1. Same as Cypress Ridge.	1. Same as Cypress Ridge.	1. Same as Cypress Ridge.
2.5.12 Socioeconomics	1. No mitigation measures are proposed for Socioeconomics.	1. Same as Cypress Ridge.	1. Same as Cypress Ridge.	1. Same as Cypress Ridge.
2.5.13 Land Use	1. No mitigation measures are proposed for Land Use.	1. Same as Cypress Ridge.	1. Same as Cypress Ridge.	1. Same as Cypress Ridge.
2.5.14 Recreation	1. No mitigation measures are proposed for Recreation.	1. Same as Cypress Ridge.	1. Same as Cypress Ridge.	1. Same as Cypress Ridge.

2.6 CONCLUSIONS

Based on the extensive evaluation presented in this Draft EIS, there would be fewer environmental impacts associated with reconfiguration of SLC-6 than with development of either the proposed Cypress Ridge site or the Boathouse Flats or Vina Terrace alternatives.

This conclusion is based on the comparison of direct and cumulative impacts and the evaluation of mitigation measures proposed to minimize and/or alleviate the direct impacts (see Table 2.3.1 and Sections 2.4, 2.5). This comparison of impacts and mitigation measures shows that, for the four sites evaluated, most environmental impacts would not be considered significant after mitigation measures were implemented. However, many of those impacts would not occur, and most others would occur on a smaller scale, if the proposed action occurred at SLC-6 rather than at one of the undeveloped sites.

Implementation of the proposed action at SLC-6 would involve extensive site demolition, modification, and construction activities. However, additional excavation or ground clearing is not anticipated, as the proposed activities would occur within areas that have been previously disturbed. Therefore, compared to the undeveloped sites, implementing the SLC-6 alternative would result in less soil loss from construction and less impact to borrow and spoil sites.

Further, with the SLC-6 alternative, impacts to vegetation and special interest plants would be significantly less, since ground clearing activities are not planned. There also would be less impact to animal habitat and individuals and to sensitive animal species. In addition, since most major facility components are already built at SLC-6, there would be less visual impact than with development of one of the other sites.

However, implementation of the SLC-6 alternative would result in greater generation of liquid hazardous waste, due to necessary modifications to the hypergolic fuel and oxidizer delivery systems prior to use for the Titan IV/Centaur. Also, because fewer personnel would be required for construction activities at SLC-6 than at an undeveloped site, there would be fewer economic benefits generated in the regional impact area during the project construction period.

Previously, the SLC-6 site was the subject of the USAF Environmental Impact Analysis Process which addressed modification of the Manned Orbital Laboratory facilities at the site to accommodate the Space Shuttle. As a result of that process, a Final Environmental Impact Statement (EIS) for the Space Shuttle program at VAFB was issued in January 1978, with a

Supplement to the Final EIS following in July 1983. Those documents addressed the construction and operation of Space Shuttle facilities at VAFB and Port Hueneme, California, activities similar to those which would occur with implementation of the proposed Titan IV/Centaur program. The implementation of the Space Shuttle program addressed in those documents would have generated greater impacts to most resources than those expected to result from the Titan IV/Centaur program now being evaluated for that site.

Overall, the reconfiguration of *SLC-6* for the Titan IV/Centaur program would result in fewer environmental impacts than would implementation of the proposed project at one of the three undeveloped sites.

3.0 AFFECTED ENVIRONMENT

For purposes of analysis, the existing environment consists of the physical area and/or elements that could be affected by implementation of the proposed action or one of the alternatives. For purposes of discussion, a distinction has been made between regional environment and local environment so that potential impacts may be put into perspective. The specific boundaries of the designated regional and local environments vary, depending upon the particular environmental parameter addressed.

For example, for geology and soils, vegetation, visual resources, cultural resources, and recreation, the regional environment consists of all of VAFB and the offshore area, while the local environment is comprised of the four potential sites and the surrounding area within South VAFB. For wildlife considerations, the regional environment is extended to marine mammals and the Northern Channel Islands. For discussions of air quality, noise, health and safety, socioeconomics, and land use, the regional environment extends into Lompoc, Santa Maria and, to some extent, all of Santa Barbara County, while the local environment includes North VAFB in addition to site-specific conditions at South VAFB. For water resources, waste management, and transportation, the regional environment consists of the North County area and North VAFB, while the local environment is considered to be all of South VAFB.

Of the four sites evaluated in detail for the proposed project, three are undeveloped and located in an area of South VAFB that is being utilized for grazing. The fourth site is a developed space launch complex located about one mile north of the other three sites. The three undeveloped sites are the proposed Cypress Ridge and alternative Boathouse Flats and Vina Terrace sites. The developed site is SLC-6, which is configured to support Space Shuttle launches but, at the present time, is in a caretaker status. Because of their common location on South VAFB, all or some aspects of the existing environment are the same for some environmental considerations, such as geology and soils, ground water, health and safety, and socioeconomics. However, for cultural resources, vegetation, wildlife, and visual resources, existing environmental conditions are quite different. In the following discussions, environmental characteristics are first addressed for the proposed Cypress Ridge site. Where appropriate, subsequent sections on the alternative SLC-6, Boathouse Flats, and Vina Terrace sites reference, but do not repeat, the initial information.

3.1 GEOLOGY AND SOILS

3.1.1 REGIONAL ENVIRONMENT

The project area lies within a region of geologic significance characterized as the western-most land termination of the Santa Ynez Mountains. Scientific interest, along with oil and gas exploration and past USAF projects, has generated detailed information on the regional and local geology of South VAFB (Dibblee 1950; USAF 1978; Payne et al. 1979; Payne and Rietman 1985). The following sections summarize the information available in these documents.

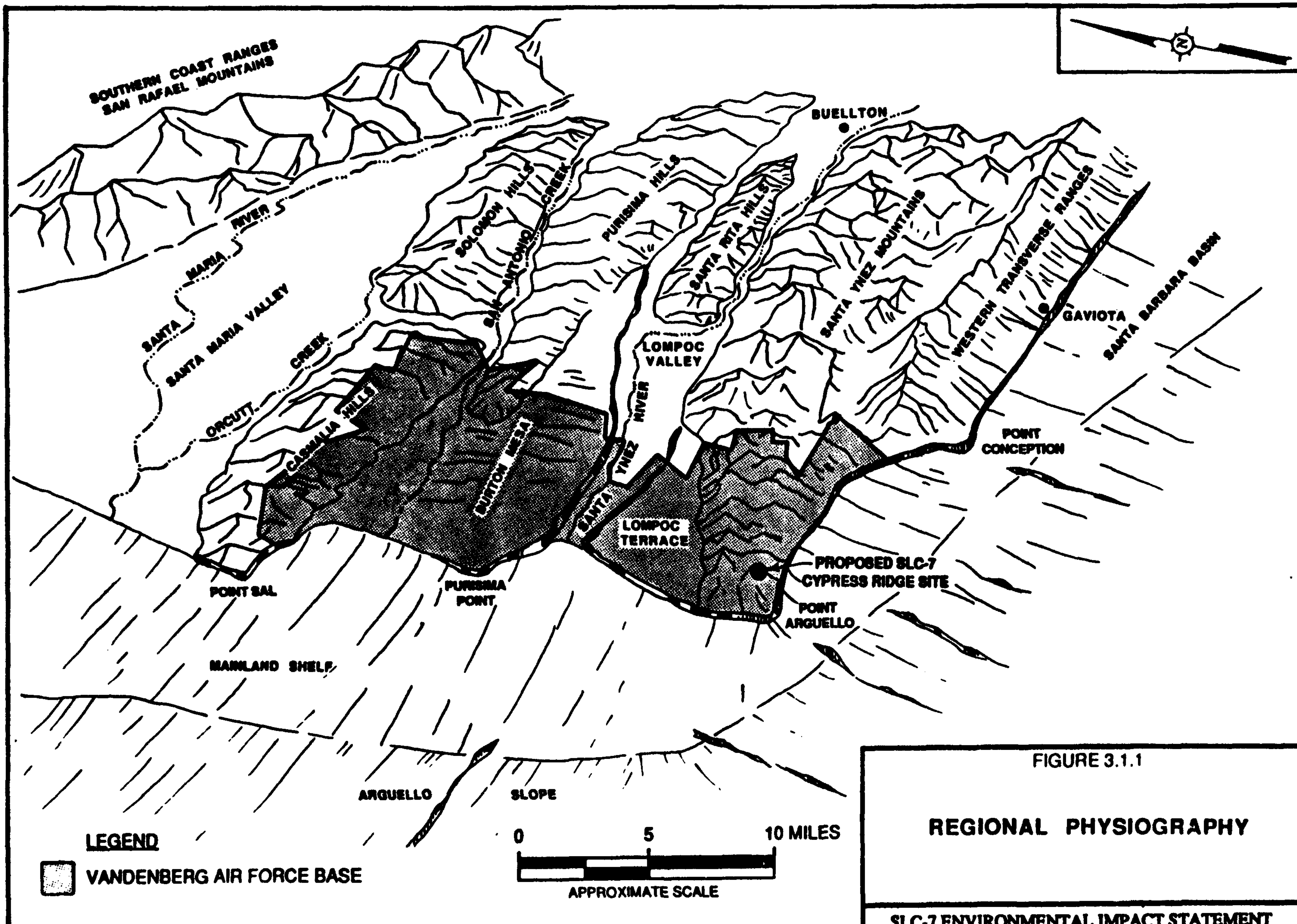
3.1.1.1 Physiography

The region encompassing the proposed SLC-7 and alternative sites includes the Santa Ynez Mountains, which consist of a parallel series of east-west trending ranges lying within the Transverse Ranges Physiographic Province of California, extending from Point Arguello to the Mojave Desert. The Pacific Ocean and Santa Barbara Channel lie west and southeast, respectively, of the mountains, and the Lompoc-Santa Ynez River Valley lies to the north. Figure 3.1.1 (Regional Physiography) is a diagrammatic map of these major physiographic features.

The western end of the Santa Ynez Mountains is characterized by steep, rugged terrain deeply incised by narrow, V-shaped canyons which are separated by steep-crested to well-rounded longitudinal ridges and saddles that reach elevations of 2,200 feet above sea level. The lower slopes of the range are rounder and smoother, with remnants of marine terraces perched discontinuously along their southwestern sides. At 50 to 100 feet above sea level, the lowest marine terrace ends at a nearly vertical sea cliff. Presently up to 2,000 feet wide, the terrace has isolated remnants beyond the shoreline, forming small islands and sea stacks.

3.1.1.2 Geology

The Western Santa Ynez Mountains consist of a thick series of deposits of marine and nonmarine sedimentary rock formations of Mesozoic and Cenozoic age. A thick section of intrusive and extrusive volcanic rocks of middle Tertiary age are interbedded with these deposits. Basement rock, consisting of the Jurassic age Franciscan assemblage, is exposed in the central northwest part of the range.



SOURCE: PAYNE AND RIETMAN 1985.

FIGURE 3.1.1

REGIONAL PHYSIOGRAPHY

SLC-7 ENVIRONMENTAL IMPACT STATEMENT

REVISED 4/6/89

Structurally, the range has been formed by north-south compression, which developed a complex series of parallel folds (synclines and anticlines) superimposed over a regional east-west trending fold. Major east-west trending, normal, and strike slip faults accompanied the regional uplift of the range. The compressional tectonism that created the present structural and geomorphic form of the range did not take place until middle Pleistocene time. Deformation since the middle Pleistocene appears to have decreased throughout the Western Transverse Ranges.

3.1.2 LOCAL ENVIRONMENT

3.1.2.1 Geology

Within the area incorporating the proposed Cypress Ridge site and the alternative SLC-6, Boathouse Flats, and Vina Terrace sites, bedrock at the surface consists of the upper Monterey Formation of upper-Miocene age. This formation has a wide distribution throughout the Santa Ynez range and is well exposed, discontinuously on upland slopes and continuously along the sea cliff. The bedrock locally consists of a hard to very hard, thinly bedded, siliceous to cherty to diatomaceous shale that has an approximate thickness of 1,600 feet near the sites.

The Monterey Formation, along the south flank of the range in the proposed project area, has a very consistent west-northwest strike and low to moderate dip angles to the southwest. No major onshore or offshore faults trend toward the project area. Minor faults confined to pre-Quaternary age bedrock most likely exist in the project area but have not been identified.

Marine terrace deposits of Pleistocene age underlie all or most portions of the project area. These nonindurated to weakly cemented deposits consist of beds and lenses of sand, silt, and gravel, and combinations of each. The deposits vary in thickness from a few to several tens of feet and unconformably overlie the Monterey Formation wave cut platforms. Both the bedding in the terrace deposits and the contact with the bedrock dip southward at an angle of less than five degrees.

Weathered material one to five feet thick covers most of the slope areas that have low to moderate gradients. Developed from the weathering of the underlying bedrock and/or terrace deposits, this debris is slowly transported downslope in response to water and gravity (creep action). Stream alluvium has accumulated on the floors of most drainages to depths of approximately two feet and is generally fine grained, with gravel fragments.

3.1.2.2 Soils

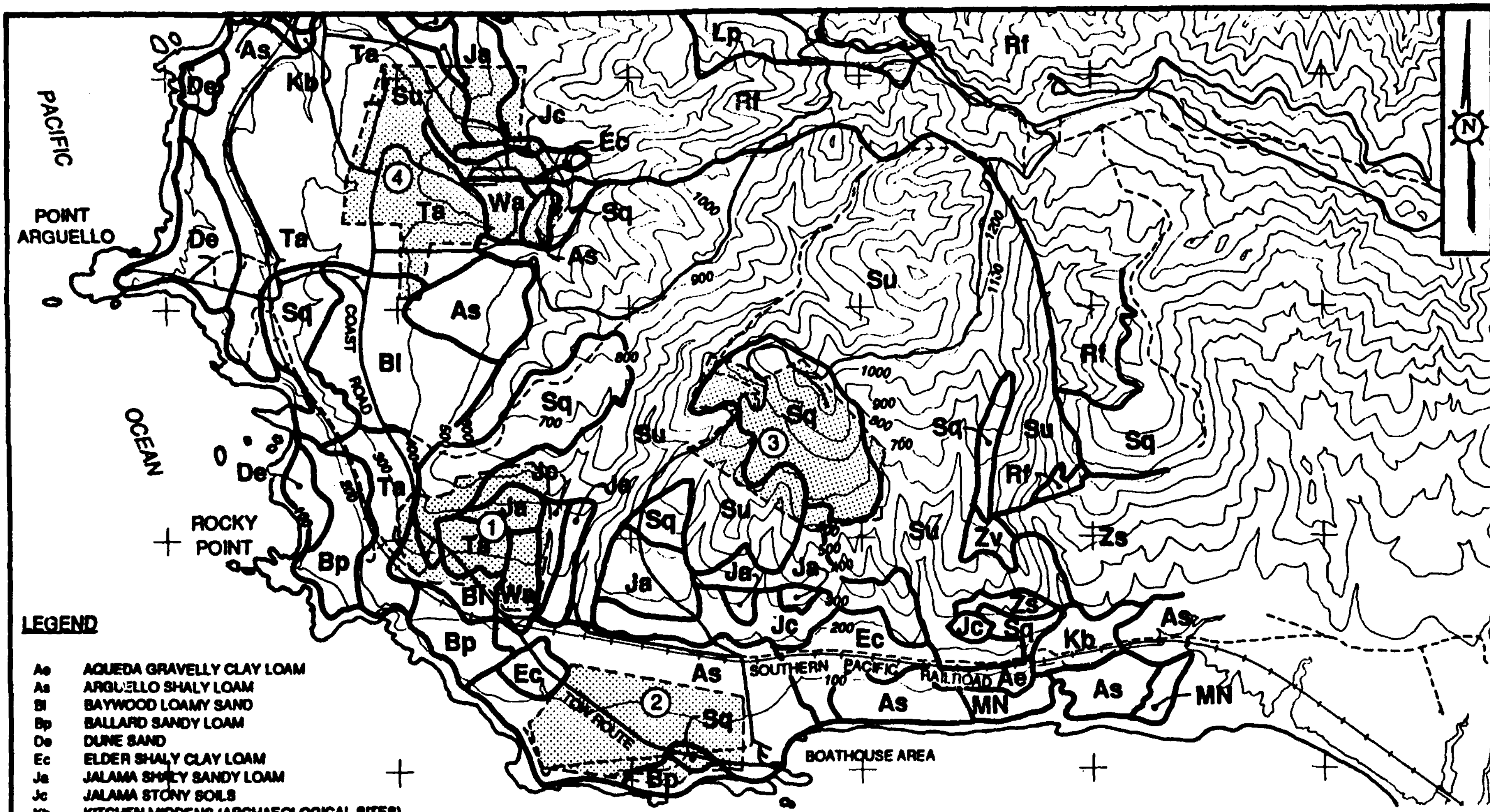
Soil deposits occur on most slopes and surfaces in the project area where bedrock is not exposed. The deposits were developed by weathering of the underlying Monterey Formation and/or terrace deposits. Some soil deposits are residual (low relief surfaces), and others are transported (slope areas). Soil thickness varies throughout the area but is generally less than three feet. In the project area, seven soil types (series) have been identified. Distribution of the various soil units is shown in Figure 3.1.2 (Local Soils Map). A brief description of the soils and soil characteristics mapped for the proposed and alternate sites is provided in Table 3.1.1 (Soil Descriptions).

Preliminary geotechnical soils information for the proposed Cypress Ridge site indicates that it is covered with terrace deposits consisting of silty sand (SM), poorly graded sand with gravel (SP), sandy clay (SC), shale or chert fragments, and other rock debris in a silty sand or sandy clay matrix. The coarser soils are permeable, and finer soils are relatively impermeable. Soil thickness and consistency (i.e., loose to firm) vary.

3.1.2.3 Faulting

Numerous onshore and offshore faults have been mapped within the vicinity of South VAFB; most are inactive and not capable of surface fault rupture or generating earthquakes (Payne and Rietman 1985). Several notable, potentially active faults (those that have ruptured in the last 500,000 years) and active faults (those that have ruptured in the last 10,000 years) are known to exist within 60 miles of the project area and are referred to as "capable" faults.

Based on the known location of the capable faults and considering the regional tectonic fabric, the likelihood of direct surface rupture in the project area is considered minimal. The identified capable faults and their parameters considered for this study are shown in Figure 3.1.3 (Geologic Structures Map) and summarized in Table 3.1.2 (Regional Capable Faults). As shown in Figure 3.1.3, these do not extend into the project area. Further, as shown in Table 3.1.2, the closest faults (from three to nine miles distant) are inactive.



LEGEND

- Ae AQUEDA GRAVELLY CLAY LOAM
- As ARGUELLO SHALY LOAM
- Bl BAYWOOD LOAMY SAND
- Bp BALLARD SANDY LOAM
- De DUNE SAND
- Ec ELDER SHALY CLAY LOAM
- Ja JALAMA SHALY SANDY LOAM
- Jc JALAMA STONY SOILS
- Kb KITCHEN MIDDENS (ARCHAEOLOGICAL SITES)
- Lp LOS OSOS STONY SOILS
- MN MONTEZUMA CLAY
- Rf RHYOLITE ROCK AND SOILS
- Sq SANTA LUCIA SHALY LOAM
- Su SANTA LUCIA STONY SOILS
- Ta TANGAIR LOAMY SAND
- Wa WATSONVILLA SANDY LOAM
- Zs ZACA SHALY CLAY LOAM
- Zv ZACA STONY SOILS

1 PROPOSED SLC-7 SITE CYPRESS RIDGE

2 ALTERNATIVE SLC-7 SITE BOATHOUSE FLATS

3 ALTERNATIVE SLC-7 SITE VINA TERRACE

4 ALTERNATIVE SLC-7 SITE SLC-6

0 2,500 5,000 FEET
SCALE

CONTOUR INTERVAL: 100'

SOURCE: USAF 1987d, VAFB MASTER PLAN - DEVELOPMENT PLAN, PREPARED BY: KEN O'BRIAN & ASSOCIATES, LOS ANGELES, CALIF.

FIGURE 3.1.2

LOCAL SOILS MAP (SOIL SERIES)

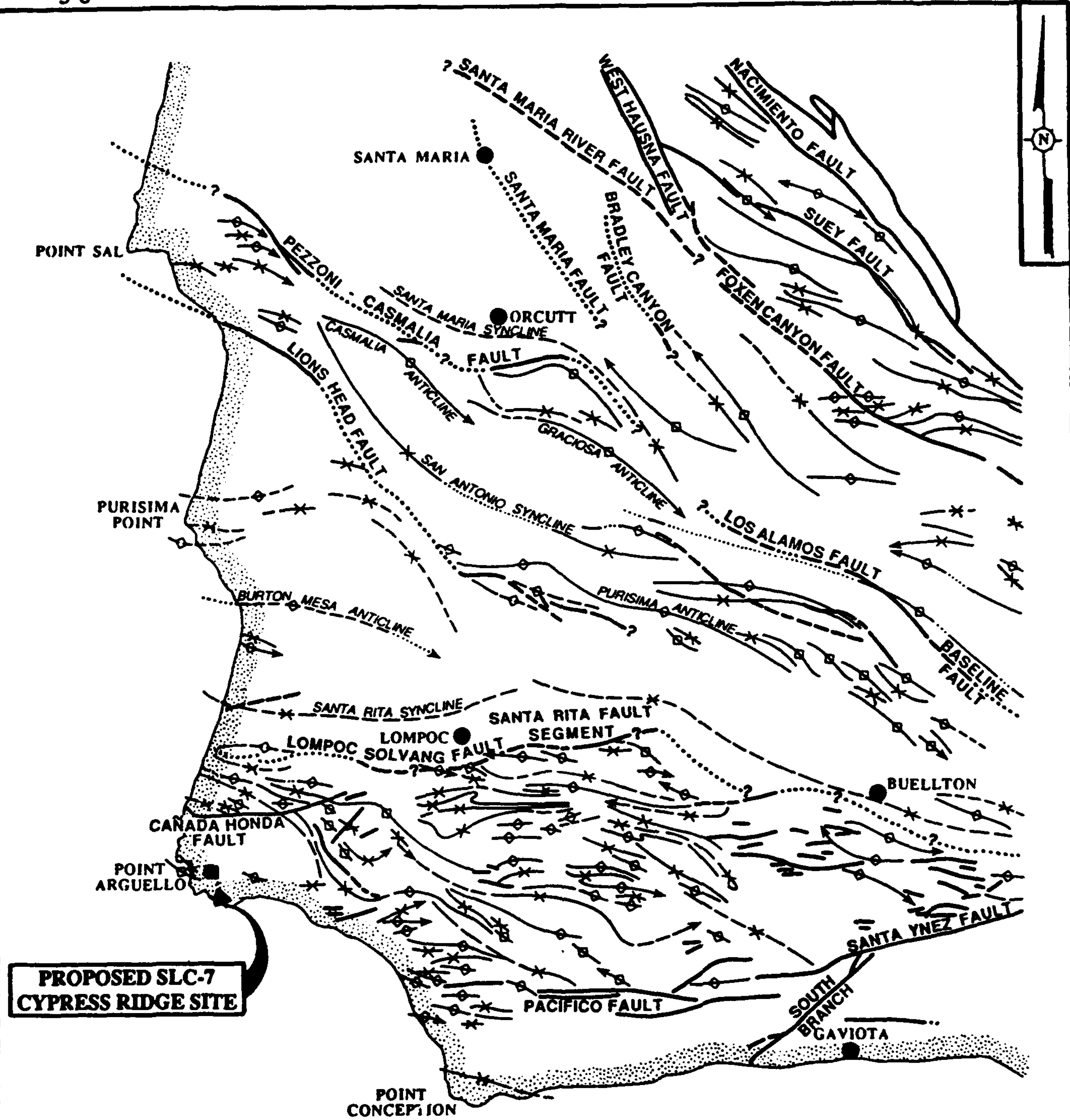
SLC-7 ENVIRONMENTAL IMPACT STATEMENT

REVISED 3/13/89

TABLE 3.1.1
SOIL DESCRIPTIONS[1]

SITE	SOIL SERIES	MAP SYMBOL	SOIL TYPE	DRAINAGE (SURFACE RUNOFF)	EROSION HAZARD	DISTRIBUTION ONSITE
Cypress Ridge	Tangair	Ta	Loamy Sand	Slow to Medium	Severe	Central (terrace)
	Watsonville	Wa	Sandy Loam	Slow	Moderate	Southeast (terrace)
	Jalama	Ja	Shaley Sandy Loam	Slow to Medium	Moderate	Northeast (slopes)
		Jc	Stony Soils, Undisturbed	Medium to Rapid	Moderate to Severe	East (slopes)
	Baywood	Bl	Loamy Sand	Very Slow to Slow	Moderate	Southwest (terrace)
	Santa Lucia	Su	Stony Soils, Undisturbed	Rapid to Very Rapid	Severe	North (slopes)
	Santa Lucia	Sq	Shaley Loam	Medium	Severe	North (slopes)
SLC-6	Tangair	Ta	Loamy Sand	Slow to Medium	Severe	West Half (terrace)
	Jalama	Ja	Shaley Sandy Loam	Slow to Medium	Moderate	Northeast
		Jc	Stony Soils, Undisturbed	Medium to Rapid	Moderate to Severe	East Central
	Santa Lucia	Su	Stony Soils, Undisturbed	Rapid to Very Rapid	Severe	North (drainage)
	Santa Lucia	Sq	Shaley Loam	Medium	Severe	Southeast (slopes)
	Arguello	As	Shaley Loam	Slow	Slight	Southeast (slopes)
	Watsonville	Wa	Sandy Loam	Slow	Moderate	Southeast (slopes)
	Elder	Ec	Shaley Clay	Slow	Severe	East Central
Vina Terrace	Santa Lucia	Sq	Shaley Loam	Medium	Severe	Central (terrace)
	Santa Lucia	Su	Stony Soils, Undisturbed	Rapid to Very Rapid	Severe	Southwest (slopes)
Boathouse Flats	Arguello	As	Shaley Loam	Slow	Slight	Central (terrace)
	Baywood	Bp	Loamy Sand	Slow	Moderate	South (slopes)
	Santa Lucia	Sq	Shaley Loam	Medium	Severe	South

[1] Source: U.S. Department of Agriculture, Soil Conservation Service 1958.



NOTE: THIS FIGURE SHOWS THE KNOWN ONSHORE STRUCTURES.

0 5 10 MILES
SCALE

EXPLANATION

ANTICLINAL AXIS AND END ARROWS INDICATE PLUNGE

SYNCLINAL AXIS, END ARROWS INDICATE PLUNGE

FAULTS, SOLID WHERE EXPOSED, DASHED WHERE INFERRED AND DOTTED WHERE DOUBTFUL OR BURIED

MODIFIED FROM: DIBBLEE (1950), WOODRING AND BRAMLETT (1950), YERKES AND OTHERS (1981), BUCHANAN AND BANKS (1978), SYLVESTER AND DARROW (1979), IN: PAYNE AND RIETMAN (1985).

FIGURE 3.1.3

GEOLOGIC STRUCTURES MAP (ONSHORE FEATURES)

SLC-7 ENVIRONMENTAL IMPACT STATEMENT

REVISED 11/14/88

TABLE 3.1.2

REGIONAL CAPABLE FAULTS

FAULT OR FAULT SYSTEMS	ACTIVITY[1]	FAULT LENGTH MILES/KM	MAXIMUM[2] EXPECTED MAGNITUDE	MAXIMUM[2] CREDIBLE MAGNITUDE	DISTANCE & DIRECTION FROM PROJECT AREA (MILES)
Hosgri Fault	A	81/135	7.0	7.5	11, NW
Santa Lucia Bank Fault	PA-A	68/114	7.1	7.5	29, W
Unnamed Faults on Santa Lucia Bank	PA-A	48/80	7.0	7.5	34, W
Offshore Lompoc Fault	A	12/20	6.3	6.5	12,NW
Offshore Purisima Fault	PA	16/26	6.3	6.5	15, NW
Point Conception (F-1) Fault Zone	A	12/20	6.3	6.5	13, SE
Molino Fault	A	5/9	5.9	6.0	22, SE
Santa Ynez Fault (with South Branch)	PA-A	80/134	7.2	7.5	20, ESE
Lompoc-Solvang (Santa Ynez River) Fault	I	-	-	-	5, N
Pacifico Fault	I	-	-	-	9, SE
Honda Fault	I	-	-	-	3, N
Lions Head	I	-	-	-	20, N
Pezzoni-Casmalia Fault	I-PA(?)	20/32	6.5	6.8	23, N
Los Alamos-Baseline Fault System	A-PA	24/38	6.5	7.0	25, ENE
Santa Maria River - Foxen Canyon - Little Pine	PA	62/100	7.0	7.4	28, NE
Santa Maria/Bradley Canyon Faults	I	-	-	-	25, NE
Big Pine Fault	A	42/70	6.9	7.25	51, E
Rinconada Fault (northern segment)	PA	111/185+	7.4	7.5	54, N
Cyuma, Ozena, Panza Faults, etc.	PA(?)	21/35	6.7	6.75	46, NE
San Andreas Fault Zone	A	678/1130	8.2	8.25	64, NE
White Wolf-Pleito Fault	A	57/95	7.0	7.75	79, NE
Garlock Fault	A-PA	150/250	7.5	7.75	98, NE

[1] A-Faults show evidence of displacement or seismicity within the last 11,000 years (Holocene Epoch); active. PA-Faults show evidence of displacement older than 11,000 years, but younger than about 500,000 years; potentially active. I-Fault shows no evidence of displacement within the last 500,000 years; inactive.

[2] Magnitude estimate from Slemmons (1977) length magnitude relationships. Magnitudes are surface wave magnitudes, (Ms). Fault lengths used in calculation are half of mapped length, based on empirical data of Albee and Smith (1966).

Source: Modified after Payne and Rietman 1985.

3.1.2.4 Seismicity

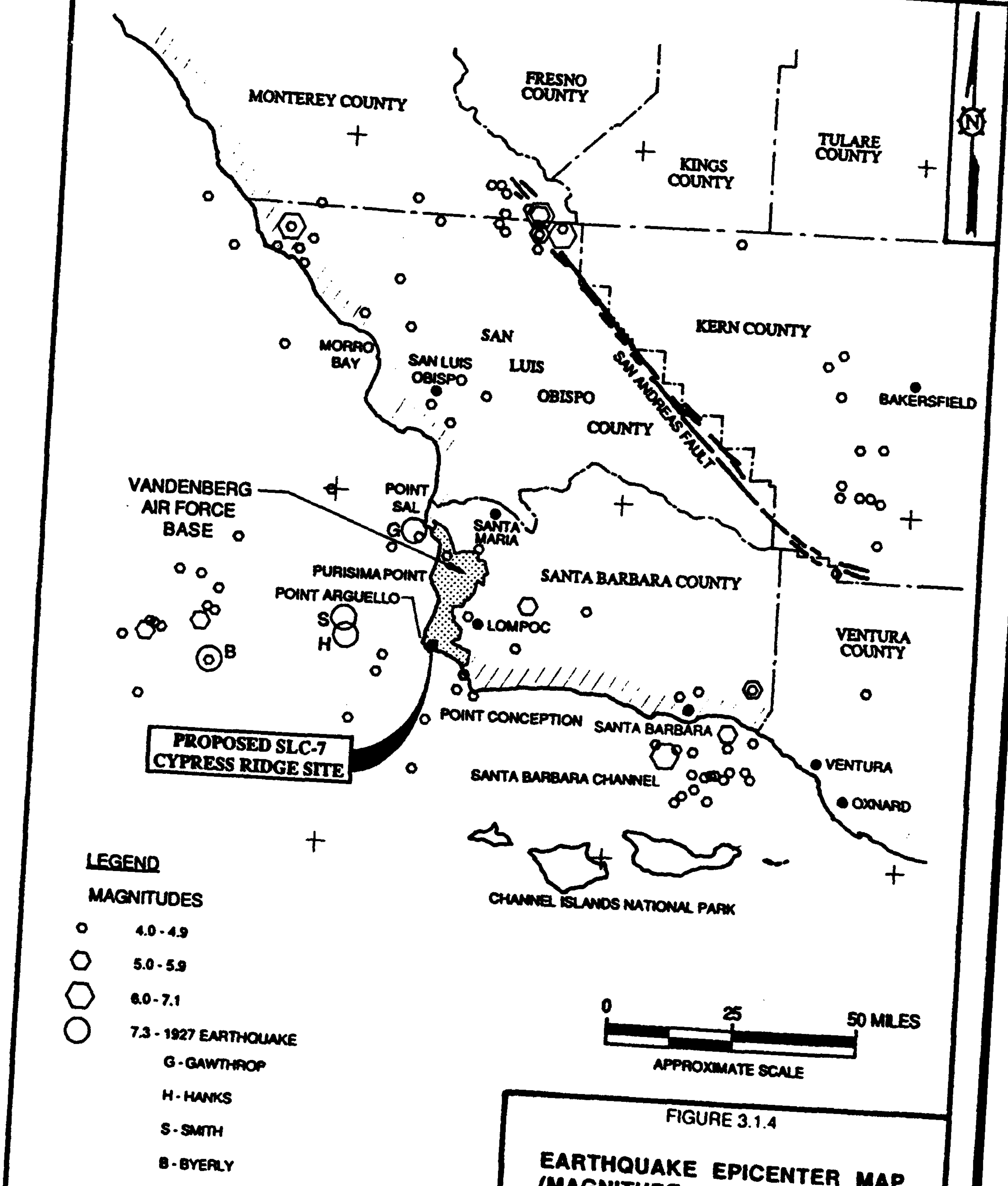
The secondary effects of fault rupture are earthquake ground motions, or seismicity. The Western Transverse Ranges, inclusive of the continental borderlands, historically have been in a moderately high seismic region. Since 1900, within a 20-mile radius of the project area, there have been over 90 minor earthquakes with magnitudes (M) ranging from 3.0 to 7.3 (Payne and Rietman 1985; Little 1984). Two of these were notable, one in 1812 (M7.1), most likely epicentered in the Santa Barbara Channel, and the other in 1927 (M7.3), offshore near Point Arguello. The 1927 event may have occurred less than 20 miles west of the project area (see Figure 3.1.4, Earthquake Epicenter Map).

Locations of earthquake epicenters are generally scattered in the Point Arguello area, although there is a concentration in the Santa Lucia Banks area approximately 40 miles to the west. Another minor concentration occurs just west of Point Conception, about 10 miles southeast of the project area. The general spatial scatter of epicenters near Point Arguello suggests these are random events associated with any known capable fault. The level of historic seismic activity is expected to continue.

The degree of ground shaking at a particular site is related to the magnitude and epicentral distance of the earthquake. In addition to ground shaking, other secondary effects of a major nearby earthquake can include liquefaction, induced flooding, subsidence, lurching, and landsliding. These potential effects are discussed below relative to the project area:

- Liquefaction: Strong shaking of loose (unconsolidated) silty and sandy soils that are saturated below the water table may cause them to liquefy and result in surface displacement, settlement, or slope failure. Based on the types and consistency of the known deposits in the project area, and the lack of a shallow saturated zone, there is a low potential for liquefaction.

- Induced Flooding: Large earthquakes or fault and underwater slide displacements can cause large surface waves to develop in the ocean or in a large inland body of water. These waves, upon encountering a shoreline, can run up and inundate near shore areas. During the 1812 Earthquake, a tsunami (large ocean wave) was reported in the region and caused localized damage. The Seismic Safety Element of the Santa Barbara County Comprehensive Plan (Santa Barbara County 1979b) recommends that a 10-foot high wave be considered and that a



REFERENCE: EARTH TECHNOLOGY CORPORATION 1984, REAL ET AL. 1978, IN: PAYNE AND RIETMAN 1985.

FIGURE 3.1.4

EARTHQUAKE EPICENTER MAP (MAGNITUDE 4.0 OR GREATER)

conservative containment elevation of 40 feet be used as a basis for the tsunami risk limit. All four project area sites are either high enough or far enough from the coast or large inland body of water to preclude the hazards of a tsunami or inundation from the rupture of an upstream reservoir.

- Induced Subsidence: Induced subsidence occurs in regions where a thick accumulation of loose, unconsolidated debris exists or where a down dropped block (graben) results from fault displacement. No evidence has been identified to suggest such conditions exist in the proposed project area.

- Lurching: Lurching involves earth motions at right angles to a cliff or, more commonly, a stream bank or artificial fill embankment. Such motions cause materials to yield in the unsupported direction, forming a series of more or less parallel cracks separating the ground into rough blocks. Locally, conditions exist where cracking could develop from lurching. Structural set-back lines can be established if necessary next to cliffs or steep slopes to avoid lurch cracking effects.

- Induced Landsliding: Major earthquake shaking can cause loose rocks or thick colluvial (soils) zones on steep slopes to move downward. Less likely, an earthquake can trigger reactivation of an ancient landslide or activate a new one. No evidence has been reported, nor do aerial photographs suggest, that major landsliding has occurred at either the proposed or alternative sites. This is a normal geotechnical concern taken into account during preliminary investigations for design.

3.1.2.5 Landsliding

Landslides can be triggered by several types of phenomena, such as stream undercutting, top-of-slope overloading, relieving support of a slope by grading, introducing water into a slope, and by dynamic shaking. Other causes may be attributed to slope denudation by fire, agricultural practices (grazing), and animal activity (rodent burrows). Adverse geologic conditions such as daylighted bedding planes, low strength soils or bedrock materials, and ground water may already exist in the slopes.

Major, deep-seated and surficial landsliding on natural slopes has been a common occurrence in the western Santa Ynez Mountains. Slope failures are triggered mainly by water infiltration, stream undercutting, slope overloading and, to a much lesser degree, by seismic loading. Geologic structure, incompetent bedrock and soil materials, slope geometry, vegetation, and other factors control the potential for slope failure.

The majority of slopes in the project area with gradients of 25 degrees or more and covered with weathered material are susceptible to creep movement. Creep consists of the soil cover and upper

weathered bedrock zone moving slowly downslope, in response to gravity and infiltrated water. These debris thicken at the toe of a slope and often are eroded and transported by stream to form alluvium in canyon bottoms.

Shallow failures (i.e., five to ten feet deep) such as slumps, rock falls, and debris or mud flows have not been identified in the immediate area of the four sites. Aerial photographs suggest this type of instability has taken place on steep, high slopes, especially along deep canyon areas (i.e., Oil Well Canyon). Deep-seated landslides have not been locally identified in the site areas. One large, ancient slide was reported on the west side of Cypress Ridge, north of the proposed site. This feature most likely involved bedrock materials and moved across bedding.

Sea cliff retreat along the shore is caused by wave undercutting and is a continuing, slow process. Failures infrequently occur in the form of rock falls and slumps and, to a minor degree, small bedding plane slides. The relatively competent bedrock exposed in the surf zone and cliff in the vicinity of the SLC-7 project area helps retard rapid degradation.

From a geologic standpoint, natural slopes on or adjacent to the four sites have been stable for many hundreds of years, although modifications to slopes, such as those that have occurred at SLC-6, may change slope conditions. Geotechnical investigations are conducted during engineering design to determine potential unstable conditions and make recommendations for safe slope design.

3.1.2.6 Erosion

Erosion of soils and bedrock materials is a continuing process caused by running water and wind. Rates of erosion are functions of soil and bedrock properties, vegetation cover, slope gradient, exposure, and climatological conditions, as well as human modifications, such as stream diversion, and denuded (i.e., by fire or grazing) or graded slopes. Soils within the proposed project area vary greatly, and those that are very sandy are more susceptible to erosion than are fine-grained deposits. Excessive erosion problems have occurred at several locations in the South VAFB area, primarily associated with developed (graded) slopes. Table 3.1.3 (Estimated Surface Water Runoff and Soil Losses, Existing Conditions) shows surface water runoff and erosion estimates for the proposed sites. The discharge points for the runoff to the ocean are shown in Figure 3.1.5 (SLC-7 Drainage Areas and Discharge Points).

TABLE 3.1.3

ESTIMATED SURFACE WATER RUNOFF AND SOIL LOSSES EXISTING CONDITIONS

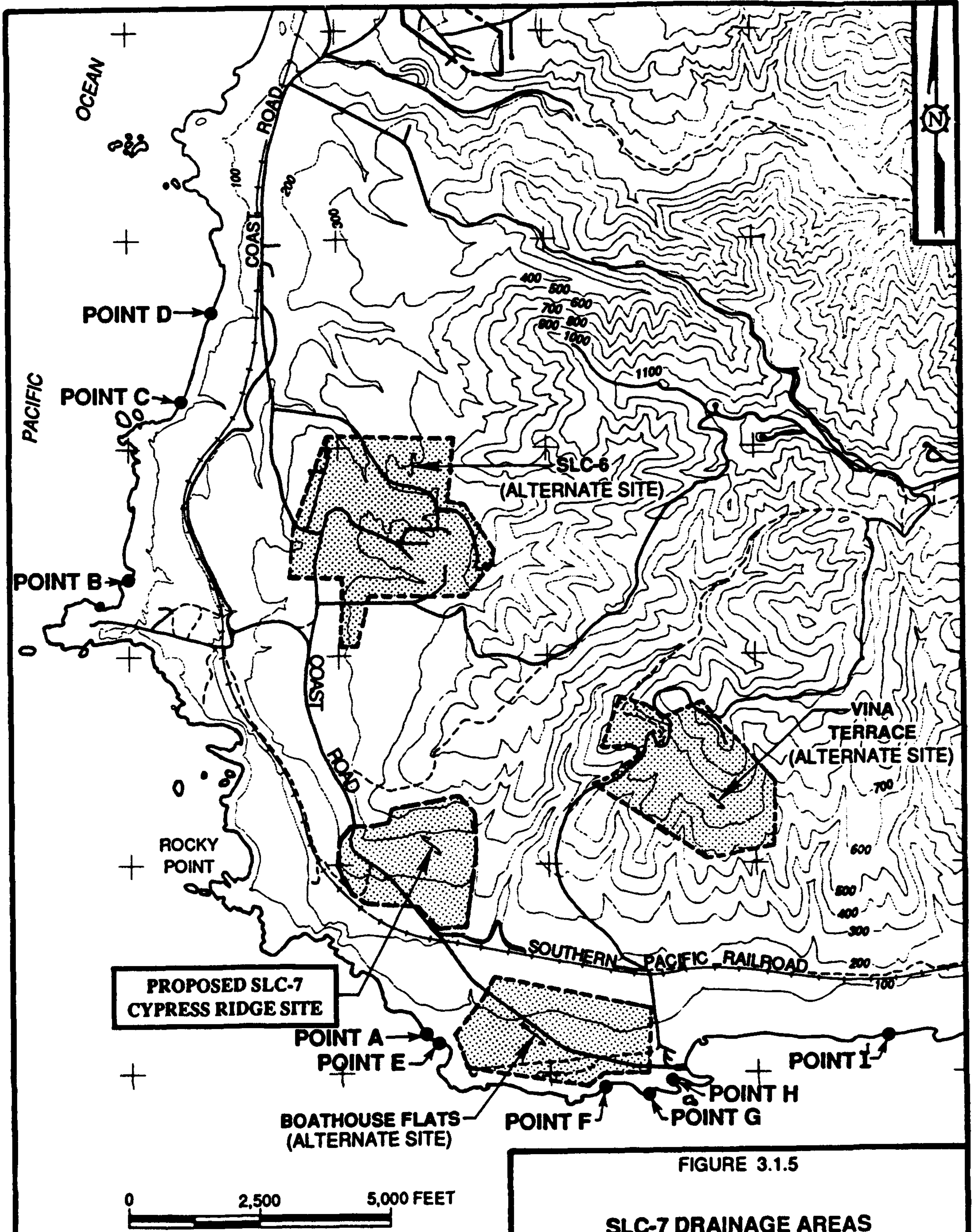
	ASSUMED DISCHARGE POINT	COMPUTED DISCHARGE [1] (cubic feet per second)		SOIL LOSSES [2]	
		25-YEAR STORM EVENT	100-YEAR STORM EVENT	INCHES/YEAR	TONS/YEAR
CYPRESS RIDGE SITE	A	370	570	0.003	60
SLC-6	B	390	590	0.007	317
	C	550	810		
	D	720	1080		
BOATHOUSE FLATS SITE	E	690	990	0.0002	4
	F	310	470		
	G	310	460		
VINA TERRACE SITE	E	690	990	0.004	90
	H	520	770		
	I	270	400		

(1) Assumptions used for surface water runoff calculations :

- The Rational Method was used to compute peak discharge from each drainage basin.
- The design point was established at the lowest elevation near the shoreline.
- The method used assumes rainfall to be uniformly distributed over the study area.
- The 25-year and 100-year rainfall intensities were determined using frequency curves from the California Department of Water Resources Jalama Beach Station.
- Time of storm duration is considered less than time of collection.

(2) Assumptions used in making soil erosion calculations:

- The soil losses are based on annual rainfall.
- The calculations of the soil losses were based on the U.S. Department of Agriculture Handbook 537, Predicting Rainfall Erosion Losses, 1987.



SOURCE: USAF 1987d. VAFB MASTER PLAN DEVELOPMENT PLAN BY KEN O'BRIAN & ASSOCIATES, LOS ANGELES, CALIFORNIA

FIGURE 3.1.5

SLC-7 DRAINAGE AREAS AND DISCHARGE POINTS

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3.1.2.7 Mineral Resources

Within the region, oil and gas are the dominant resources and have been recovered in the Santa Maria Basin, both onshore and offshore. The Santa Maria Basin yields low gravity oil from fractured Monterey Shale. The closest oil field is Point Arguello - Point Pedernales, located about five miles southwest of the proposed project area. Oil is actively being extracted from this field by offshore platforms.

Five oil exploration wells were drilled in the proposed project area between 1925 and 1953, ranging from depths of 1,200 to 2,500 feet. Geologic structures and formations underlying the proposed project area are similar to known production zones offshore. Reportedly, none of the wells (oil or gas) showed yields of economic importance and have been abandoned per regulations of the California Division of Oil and Gas.

There are no known economic metallic or non-metallic resources in the project area (Dibblee 1950). Diatomite, limestone, and road construction materials are the main resources in the Western Santa Ynez Mountains, and known economic occurrences of these materials lie more than five miles north and east of the proposed project area.

3.1.3 SITE-SPECIFIC ENVIRONMENT

3.1.3.1 Cypress Ridge

The Cypress Ridge site extends from an elevated marine terrace (southerly two-thirds) onto the lower slopes of Cypress Ridge (northern one-third). The terrace portion consists of a relatively smooth, shallow, south-facing slope with a gradient of about six percent. The lower slope also faces south, but has a steeper gradients up to 33 percent. The site lies between 200 and 600 feet above sea level with a total relief of 400 feet from south to north.

Cypress Ridge is a northeast trending, longitudinal ridge that lies along the westerly and northerly site boundaries and attains an elevation of about 800 feet above sea level locally. An unnamed, south flowing, intermittent drainage traverses the east side of the parcel and is up to 150 feet deep with moderately steep side slopes. South of the site, the terrace surfaces slowly merge with a lower and younger elevated marine terrace of very low relief.

Only minimal degradation on the slopes or low relief surfaces within or adjacent to the site has occurred. Erosion potential for soils is moderate to severe (see Figure 3.1.2 and Table 3.1.1) surface drainage is either by direct infiltration or by sheet wash toward the south. No active stream channels traverse the site. Based on aerial photographic analyses, the slopes have not been modified by deep-seated landsliding, nor has there been excessive erosion.

A small shale quarry exists on the southwest side of Cypress Ridge, opposite the proposed site. The quarry reportedly was used in the past for road material, but has not been used for about 20 years. This quarry is now regarded as closed by the USAF and, therefore, has no future economic value.

3.1.3.2 SLC-6

The SLC-6 site is located adjacent to lower slopes of the Santa Ynez Mountains on an elevated marine terrace. Developed portions of the site have been graded and are not reminiscent of the original topography. Adjacent undeveloped areas slope gently to the west with an average gradient of about five percent. The site lies generally between 200 and 500 feet above sea level with a total relief of about 300 feet from west to east.

The SLC-6 area is bounded on the north and south by two drainages. The southerly drainage extends from a large canyon east of the site to a discharge point about one mile to the northwest. The northerly drainage, known as Red Roof Canyon, extends from developed slopes of SLC-6 northwest to a discharge point over one mile from the site. Both drainages have steep side slopes.

Some erosion of soils is evident at points along the drainages bounding the SLC-6 site. As shown in Table 3.1.1, the erosion potential of most onsite soils is severe. Slope stabilization measures have been implemented, especially adjacent to Red Roof Canyon where excessive erosion required cement gunite to protect graded slopes.

3.1.3.3 Boathouse Flats

The Boathouse Flats site is situated entirely on the lower most prominent terrace surface adjacent to the sea cliff. The surface is of very low relief, lying between 50 and 150 feet above sea level. The nearest upland slopes lie approximately 2,000 feet north of the northern site boundary.

The terrace surface is very continuous and dominates the coastline for many miles. The surface was formed on a wave cut platform about 120,000 years ago and subsequently has been uplifted to its present position. During the uplifting process, the sea cliff was formed by wave action and now is 40 to 50 feet high south of the site. Locally, the cliff is nearly vertical and very irregular, and small coves have developed as a result of differential wave erosion of bedrock materials. The majority of onsite soils have slight potential for erosion.

South-flowing streams trend out of the uplands toward the site but have not incised the terrace surface. Within the site, drainage is mostly by direct infiltration and sheet wash toward the south. Minor terrace incision has developed across the surface south of Oil Well Canyon. This drainage lies along the westerly boundary of the site. The sea cliff is over-steepened adjacent to the site, which has resulted in occasional rock falls and small slumps due to undercutting by waves.

3.1.3.4 Vina Terrace

The Vina Terrace site lies entirely on a perched, isolated, ancient marine terrace between 600 and 800 feet above sea level. The terrain is relatively smooth, well rounded, and mildly undulatory, with an average gradient of less than six percent to the south and southwest. This terrace surface forms a broad midslope step along the south flank of the Santa Ynez Mountains. Slopes above and below the terrace surface are noticeably steeper, with gradients of 50 percent and greater.

The irregular shape of the terrace surface is a result of stream degradation. Several southward flowing intermittent drainages have slowly worked headway (north) into the area, isolating it from other terrace surfaces of the same age, elevation, and origin. Oil Well Canyon trends along the west side of the site and has been deeply incised by stream erosion, on the order of 250 feet opposite the site. Side slopes are relatively steep.

Drainage across the site is mostly by direct infiltration and sheet wash. Minor incision has occurred in shallow swale areas. Erosion potential of onsite soils is severe. Degradation within the site by erosion, landsliding, or surficial slope failure is not apparent based on aerial photographs. Small, older landslides may have occurred locally on over-steepened side slopes below and adjacent to the site. Creep-affected colluvium has accumulated on moderately steep slopes below, and possibly above, the parcel.

3.2 WATER RESOURCES

3.2.1 REGIONAL ENVIRONMENT

3.2.1.1 Surface Water

Three major drainage areas lie near VAFB. On the northern boundary of VAFB, the Santa Maria River forms the Santa Maria drainage system. The southern boundary is located near Jalama Creek and the Jalama Creek drainage system. The Santa Ynez River bisects North and South VAFB and comprises the core of the Santa Ynez drainage system. One minor drainage, San Antonio Creek, is present on North VAFB and forms the San Antonio drainage system.

3.2.1.2 Ground Water

The communities located in the Lompoc and Santa Maria Valleys, including North VAFB, are supplied with water from wells located in the Santa Ynez, San Antonio Creek Valley, and Santa Maria watersheds. The city of Lompoc and the surrounding unincorporated communities receive their water from wells drilled in the Lompoc Plain and Lompoc Upland ground water basins, as shown in Figure 3.2.1 (Ground Water Basins, VAFB Vicinity). These basins are fed with runoff from the Santa Ynez watershed, which encompasses an area of about 900 square miles. The working capacity of the two basins is about 300,000 acre-feet, with an annual recharge rate of 33,000 acre-feet. Total demand on the basins is about 38,000 acre-feet per year. Because the demand exceeds supply, the basins are considered to be in overdraft of 5,000 acre-feet of water per year (USAF 1987a).

North VAFB receives about 30 percent of its water from the Lompoc Plain ground water basin and about 70 percent from the San Antonio Creek Valley basin. Total demand on the San Antonio ground water basin is about 20,000 acre-feet per year. Of this amount, North VAFB uses approximately 4,000 acre-feet per year. The San Antonio Creek Valley ground water basin has a recharge rate of about 8,000 acre-feet per year, with a working capacity of about 500,000 acre-feet. The present usage of the basin results in an overdraft of 12,000 acre-feet per year (USAF 1987a).

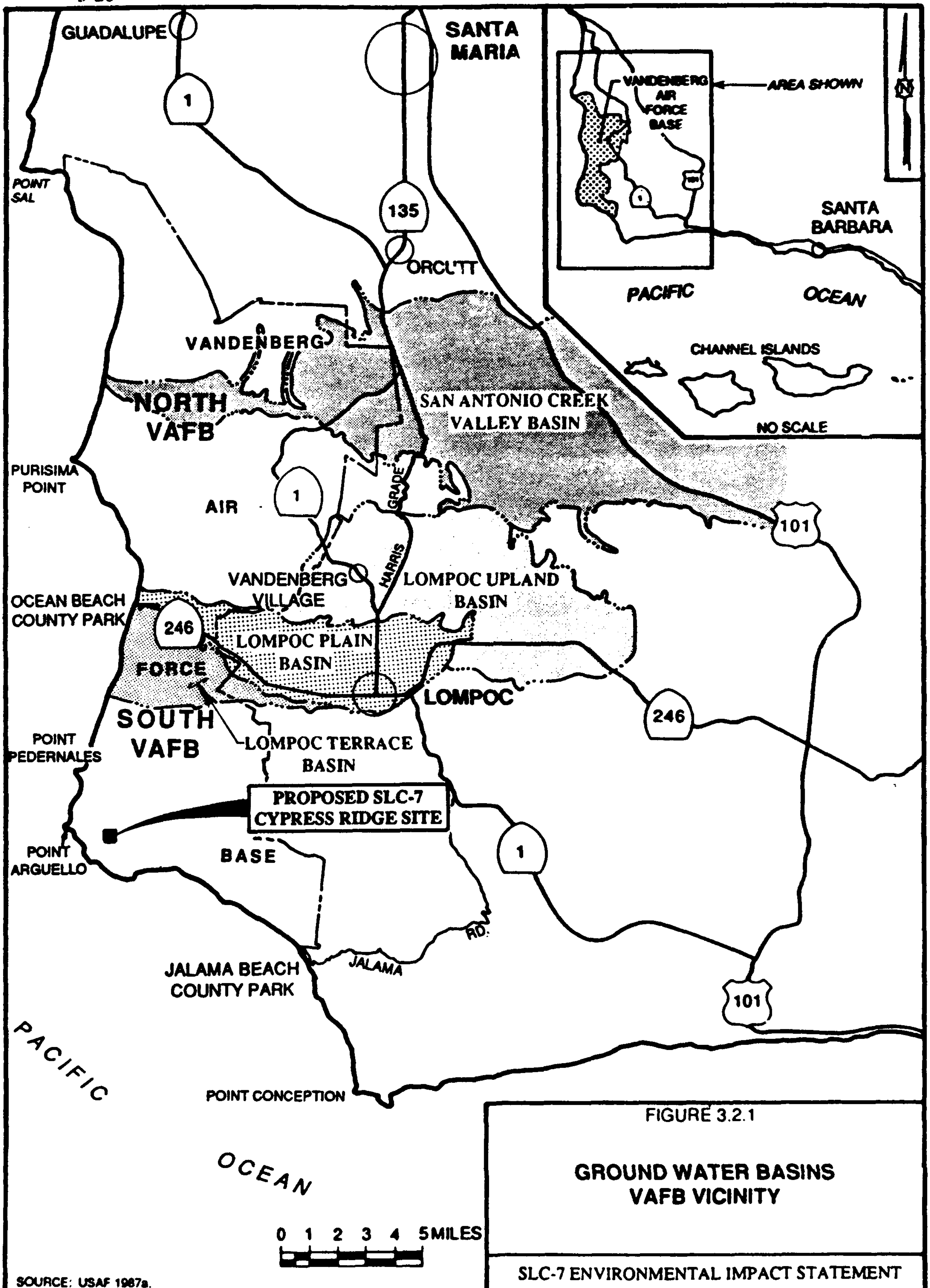

FIGURE 3.2.1

GROUND WATER BASINS VAFB VICINITY

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Santa Maria receives its water from wells drilled in the Santa Maria ground water basin. Present demand on this basin is about 112,000 acre-feet per year, with 78 percent for agricultural use. This basin is capable of supplying about 91,000 acre-feet per year without being in overdraft. It currently is being overdrawn at a rate of 21,000 acre-feet per year (CDWR 1985).

Ground water quality in the region meets all National Interim Primary Drinking Water Regulations (NIPDWR) standards (USAF 1987a). Continued overdraft of the ground water basins could lead to a decrease in the water table levels and a compaction of the basins. A slight decrease in water quality has been occurring in the region due to the use of water for irrigation. As this water flows through the soil back to the basin, it entrains salts and leads to a buildup of salts in the ground water (USAF 1982a).

3.2.2 LOCAL ENVIRONMENT

3.2.2.1 South VAFB

Surface Water

The Western Santa Ynez Mountains located within South VAFB receive an average annual precipitation of about 16 inches per year, with runoff rates of two to three inches per year (USGS 1985). South VAFB has no permanent lakes, impoundments, rivers, or flood plains, but does have several streams that drain directly into the ocean. Discharge rates for the various local minor and major drainages have not been measured. Depending on the intensity of storms, runoff from local streams would be expected to give high intermittent yields due to the area's relatively steep topography.

The main drainage within South VAFB is Honda Creek, with a watershed of about 12 square miles. The Honda Creek drainage lies about three miles north of the proposed project area. Springs associated with Cañada Honda Fault usually issue a minimal flow of water to the watershed.

Cañada Agua Viva is a south-flowing, perennial drainage located east of the project area and fed by two springs near Wild Horse Flats. Perennial yields from this drainage are expected to be less than five gallons per minute (gpm), or 60 acre-feet per year. Cañada Agua Viva has a watershed area of approximately one square mile.

Oil Well Canyon, located in the southern portion of the project area, flows south, fed by two springs near its upper reaches. Surface flow is intermittent. Oil Well Canyon has a total watershed area of about one square mile. Several other, smaller, intermittent (ephemeral) drainages run north into and/or through the project area. Each drainage has a small watershed area associated with it (USAF 1988a).

Little information is available on surface water quality in the project area. Results of samples taken from near SLC-6, Oil Well Canyon, and Cañada Agua Viva drainages are shown in Table 3.2.1 (Surface Water Quality, Point Arguello Area). Notably high values of total hardness, specific conductance, and total dissolved solids are due mainly to the intermittent nature of the drainages and the weathered shale bedrock in the watershed.

Ground Water

The South VAFB water supply system is independent of and isolated from the North VAFB system. The South VAFB system derives its water from the Lompoc Terrace ground water basin, shown in Figure 3.2.1. This basin is well defined by faults to the north and south, the Pacific Ocean on the west, and the younger alluvium of the Santa Ynez Valley to the east (Evanson and Miller 1963). These distinct boundaries keep the basin almost entirely within South VAFB. The basin covers an area of 4,800 acres and has a total storage capacity of 60,000 acre-feet (Evanson and Miller 1963). The estimated recharge of 250 acre-feet per year is limited due to low annual precipitation and basin characteristics (USAF 1988a). Presently, South VAFB is the only user of water from the basin.

Two wells drilled in Lompoc Canyon, known as Well 1 and Well 3, tap the Lompoc Terrace ground water basin and supply the South VAFB water system at a current rate of about 260 acre-feet per year. The wells are located approximately five miles northeast of the project area, as shown in Figure 3.2.2 (South VAFB Existing Production Wells). Ground water levels measured over the last 10 years indicate a fairly stable water table, even though withdrawal rates have varied significantly (see Figure 3.2.3, South VAFB Ground Water Withdrawal Rates). A high of 350 acre-feet per year was pumped from the wells in 1984 during SLC-6 construction. Figure 3.2.3 shows no significant decrease in ground water levels due to the increase in water production at that time. The quality of water from the Lompoc Terrace ground water basin is considered good and requires little treatment, as shown in Table 3.2.2 (Inorganic Constituents, Lompoc Terrace Ground Water Basin) and Table 3.2.3 (Organic Constituents, Lompoc Terrace Ground Water Basin).

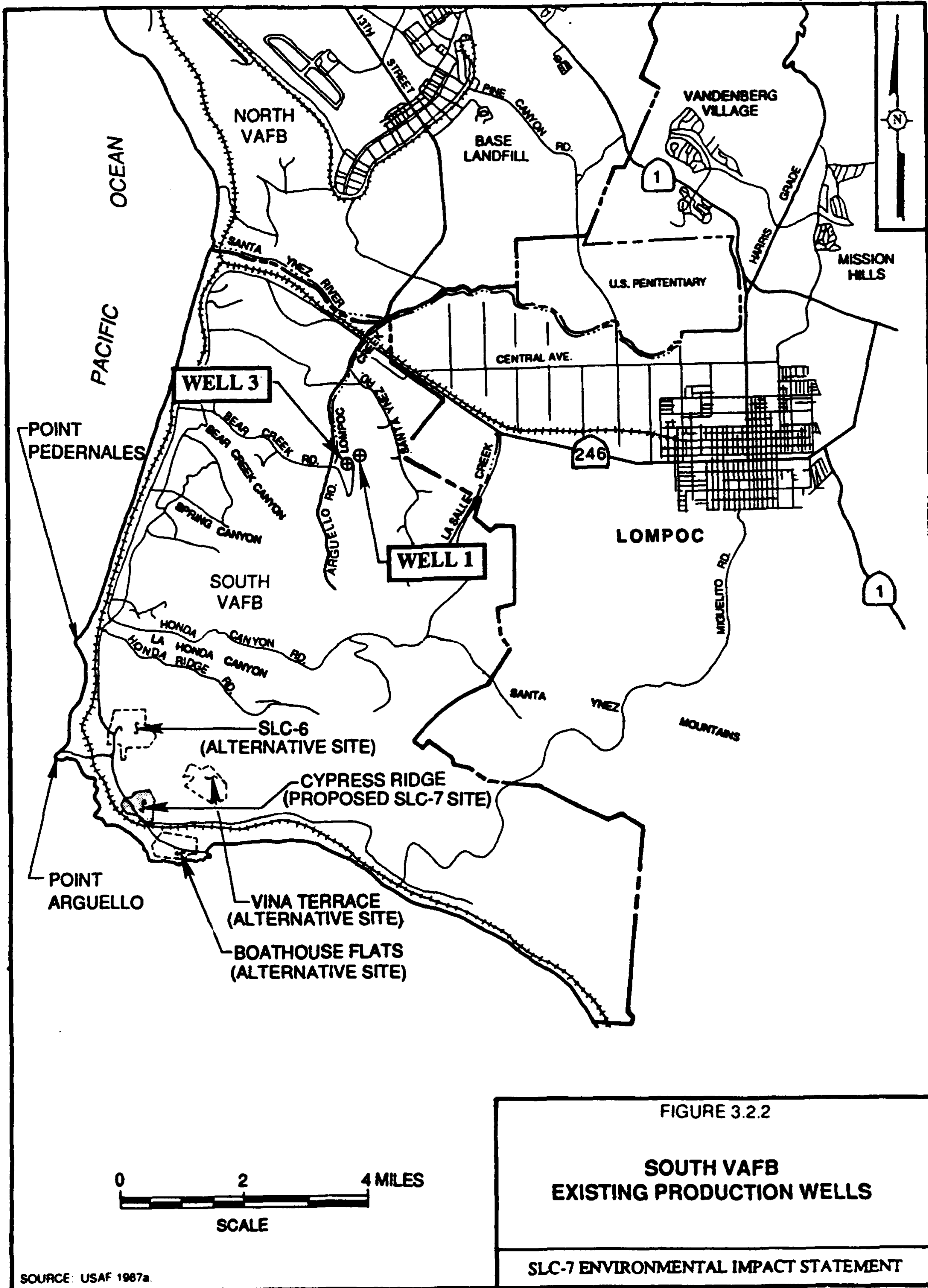

FIGURE 3.2.2

SOUTH VAFB EXISTING PRODUCTION WELLS

SLC-7 ENVIRONMENTAL IMPACT STATEMENT

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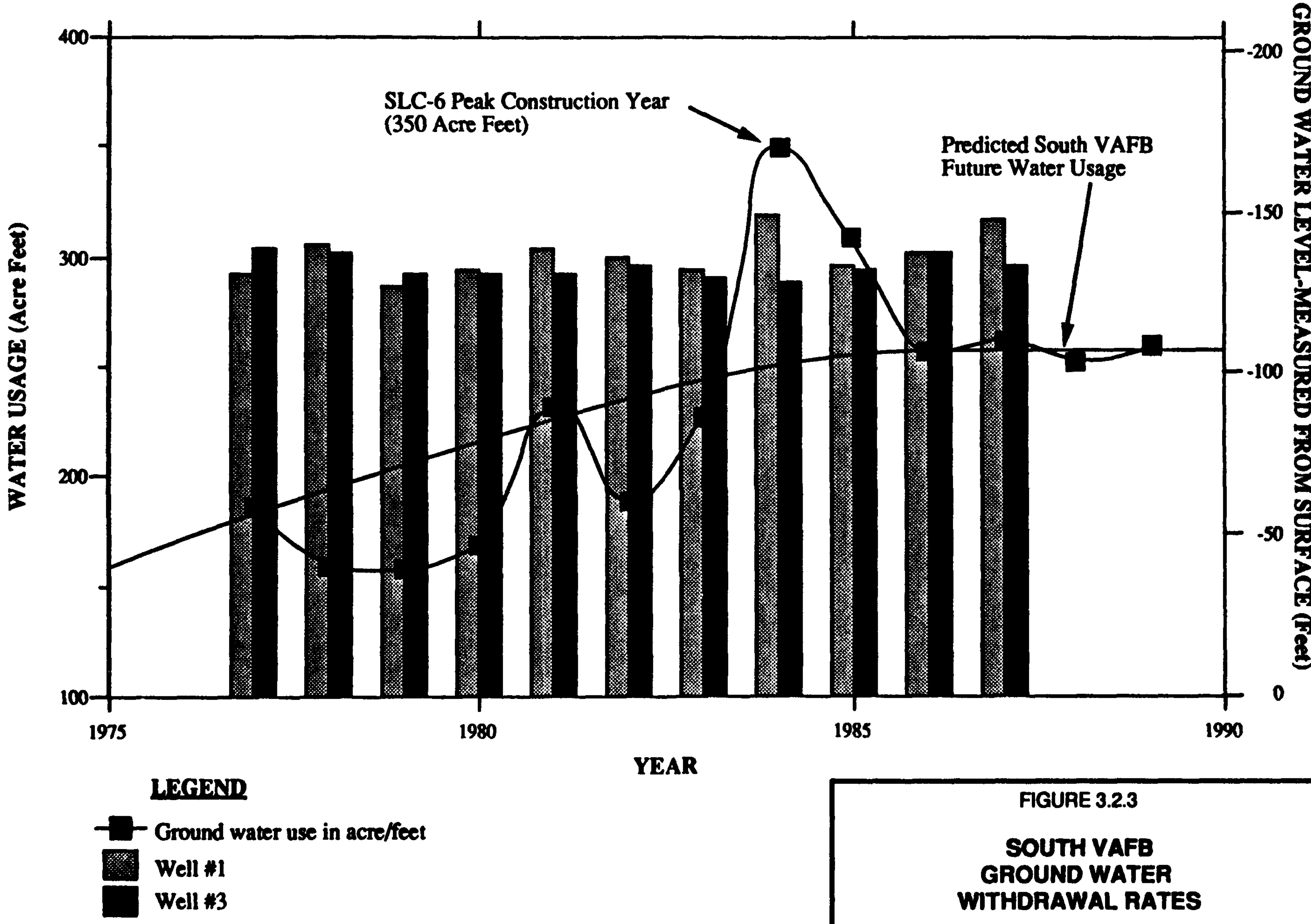


Source: USGS 1988.

FIGURE 3.2.3

SOUTH VAFB GROUND WATER WITHDRAWAL RATES

SLC-7 ENVIRONMENTAL IMPACT STATEMENT

TABLE 3.2.1

SURFACE WATER QUALITY POINT ARGUELLO AREA

PARAMETER [a]	SLC-6 [b,d] CANYON	OIL WELL [b,d] CANYON	CAÑADA [c,d] AQUA VINA	DRINKING WATER STANDARDS/ CRITERIA [e]
Watershed Area (acres)	323	706	570	NA
pH (pH units)	7.7	7.8	9.6	5.0-9.0
Chemical Oxygen Demand	86	57	10	NS
Total Organic Carbon	13	7	7	NS
Oil and Grease	0.38	0.45	1.5	NS
Nitrate	0.35	0.45	0.5	45
Phosphate	NR	NR	NR	NS
Cadmium	NR	NR	NR	0.01
Chromium	NR	NR	NR	0.05
Iron	4.9	0.394	17	0.3
Lead	NR	NR	NR	0.05
Zinc	NR	NR	NR	5.0
Calcium	84	79	99	NS
Magnesium	60	72	86	NS
Potassium	8	8	14	NS
Sodium	184	139	130	NS
Total Hardness	470	500	1,100	400
Aluminum	3.922	0.516	9.5	NS
Chloride	352	354	300	250
Total Dissolved Solids	1,207	1,095	2,100	500
Specific Conductance	1,584 µmho/cm	1,374 µmho/cm	2,400 µmho/cm	1,600 µmho/cm
Sulfate	159	167	980	250
Turbidity	98 NTU	14 NTU	130 NTU	5 NTU
Total Acidity	40	42	20	NS
Alkalinity	292	249	250	400
Dissolved Oxygen	9.5	9.1	9.6	NS

NR = Not reported
NS = No established standard
NA = Not applicable

[a] Mg/L, except where noted.

[b] Mean values from samples taken in 1986.

[c] Value from single sample 3/31/86.

[d] Source: USAF 1988a.

[e] Source: CCR, Title 22, Chapter 15, Article 5, Part 64435.

TABLE 3.2.2

INORGANIC CONSTITUENTS LOMPOC TERRACE GROUND WATER BASIN

CONSTITUENT[a]	YEAR					DRINKING WATER STANDARDS/ CRITERIA[e]
	1975[b]	1980[c]	1983[c]	1986[c]	1987[d]	
Arsenic	NR	<0.01	<0.01	<0.01	NR	0.05
Barium	NR	<1.0	<0.2	<0.2	NR	1.0
Cadmium	NR	<0.01	<0.01	<0.01	NR	0.01
Calcium	55	106	135	70	37	NS
Chloride	130	222	180	128	130	250
Chromium	NR	<0.05	<0.05	<0.05	NR	0.05
Copper	NR	<0.14	<0.22	<0.02	NR	1.0
Fluoride	0.3	0.2	0.15	0.5	0.3	0.7
Iron	6.6	<0.1	<0.05	<0.24	0.014	0.3
Lead	NR	NR	NR	NR	NR	0.05
Magnesium	28	29	32	28	20	NS
Manganese	0.03	<0.05	<0.05	<0.05	<1	0.05
Mercury	NR	<0.002	<0.001	<0.001	NR	0.002
Selenium	NR	<0.01	<0.01	<0.01	NR	0.01
Sodium	90	89	78	70	81	NS
Silver	NR	<0.01	<0.01	<0.01	NR	0.05
Sulfate	94	116	84	77	38	250
Zinc	NR	<0.05	<0.025	<0.05	NR	5.0
Dissolved Solids	533	734	882	534	415	500
Total Hardness (as $CaCO_3$)	250	382	471	291	170	400[f]
Alkalinity (as $CaCO_3$)	167	184	182	176	113	400[f]
pH	7.1	7.3	7.0	6.8	7.3	5.0-9.0[f]

NR = Not reported
NS = No standard

[a] Concentrations in Mg/L, except pH.

[b] Source: USAF 1978.

[c] Source: USAF 1988a.

[d] Reference: USGS 1988.

[e] Reference: CCR, Title 22, Chapter 15, Article 4, Part 64435.

[f] Reference: US EPA 1986.

TABLE 3.2.3

ORGANIC CONSTITUENTS
LOMPOC TERRACE GROUND WATER BASIN

CONSTITUENT [a]	YEAR				DRINKING WATER STANDARDS/ CRITERIA [c]
	1977 [b]	1980 [b]	1983 [b]	1986 [b]	
2,4 - D	<0.06	ND	ND	<0.06	100.0
2,4,5 - TP Silvex	<0.06	ND	ND	<0.06	10.0
Endrin	<0.02	ND	ND	<0.02	2.0
Lindane	<0.01	ND	ND	<0.01	4.0
Methoxychlor	<0.04	ND	ND	<0.20	100.0
Toxaphene	<2.00	ND	ND	<1.0	5.0
PCBs	NR	NR	NR	<1.0	NS [d]

NR = Not reported
ND = Not detectable
NS = No standard

[a] Concentrations in µg/L.

[b] Source: USAF 1988a.

[c] CCR, Title 22, Chapter 15, Article 4.

[d] Recommended level as specified in the Handbook of Toxics and Hazardous Chemicals and Carcinogens, 1985, 2nd ed., is 0.0 µg/L.

3.2.2.2 Cypress Ridge

Surface Water

Much of this site is part of the Oil Well Canyon watershed, which flows in a channel adjacent to the eastern boundary of the site. No channels traverse the site, leaving runoff to be removed by sheet wash into adjacent drainages or onto a lower terrace.

Surface water runoff has been estimated at 370 and 570 cubic feet per second (cfs) for 25-year and 100-year storm events occurring at the site, as shown in Table 3.1.3. These values pertain to the entire site drainage area. The discharge point for surface water runoff to the ocean from the Cypress Ridge area is shown in Figure 3.1.5 as Point A.

Ground Water

The underlying Monterey Formation is common to both the proposed Cypress Ridge site and SLC-6 and supports minimal amounts of ground water in fracture zones. Small quantities of water are contained in the upper member of the formation, in fractured diatomaceous and siliceous shales. Somewhat greater quantities are contained in the lower member, in fractured limestone and siliceous shale. This formation has produced yields of one to 30 gallons per minute in five water supply wells drilled in the vicinity of SLC-6, with depth to water in 1982 ranging from 70 to 131 feet, the most distant well being about 1.3 miles north of the proposed Cypress Ridge site. In addition to low yield, these wells have yielded water of relatively poor quality. Data available from four of the wells and three springs show that the water is generally of poor quality, being relatively high is dissolved solids (an average of 1,150 mg/L), hardness (an average of 617 mg/L), and chloride (an average of 343 mg/L) (USAF 1982b). Due to the high chloride concentration, the water yielded from these wells is not recommended for either drinking or irrigation (USAF 1982b).

No appreciable ground water resources have been found to date within the boundaries of the proposed Cypress Ridge site. The only ground water at the present time comes from small springs on the ridge between the site and Oil Well Canyon.

3.2.2.3 SLC-6

Surface Water

No perennial streams or springs exist on the SLC-6 site. Erosion control ditches are used to direct surface water runoff created during storm events to a small arroyo on the north side of the SLC-6 complex. From this arroyo, the water flows toward the ocean and either flows into the ocean or is absorbed into the soil before it reaches the ocean.

Surface water runoff has been estimated at 1,660 and 2,480 cfs for 25-year and 100-year storm events, as shown in Table 3.1.3. Discharge points for the site are shown in Figure 3.1.5 as Points B, C, and D.

Ground Water

Ground water conditions applicable to SLC-6 are addressed in the section on the proposed Cypress Ridge site (Section 3.2.2.2).

3.2.2.4 Boathouse Flats

Surface Water

The Boathouse Flats site occupies the lowest marine terrace in the project area. During rainfall events, drainage from Oil Well Canyon spills out across the terrace. The natural drainage of the terrace has been affected by the recontouring done during construction of the Space Shuttle External Tank Tow Route. Sheet wash drains the rest of the site toward the coastal bluffs and into the ocean.

Surface water runoff for the site has been estimated at 1,310 and 1,920 cfs for 25-year and 100-year storm events, as shown in Table 3.1.3. Discharge points for the site are shown in Figure 3.1.5 as Points E, F, and G.

Ground Water

Ground water conditions at the Boathouse Flats site are similar to those at the Cypress Ridge site.

3.2.2.5 Vina Terrace

Surface Water

Vina Terrace is the oldest, highest, and steepest marine terrace of the four sites and is deeply incised by channels. Oil Well Canyon provides drainage along the northern perimeter of the site with smaller, unnamed watersheds providing drainage over the rest of the site. Past performance indicates that channels traversing the terrace appear adequate to handle the normal canyon discharges.

Surface water runoff has been estimated at 1,480 cfs for a 25-year storm and 2,160 cfs for a 100-year storm, as shown in Table 3.1.3. Figure 3.1.5 shows the discharge points for runoff to the ocean from this site as Points E, H, and I.

Ground Water

Ground water conditions at the Vina Terrace site are similar to those at the Cypress Ridge site.

3.3 VEGETATION

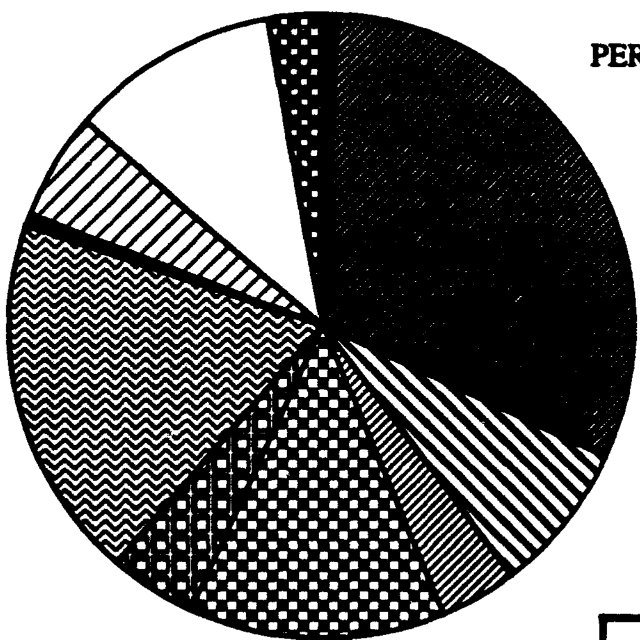
3.3.1 REGIONAL ENVIRONMENT

The regional environment defined for the vegetation analysis consists of all of VAFB and the adjacent area. The topographic and geologic diversity of this region has resulted in an environment exhibiting a great species diversity and a high rate of endemism. In addition, VAFB is located in what is considered the transition zone between the cool, moist conditions of northern California and the semi-desert conditions of southern California. Consequently, many species reach their northern or southern limits in this area (Howald et al. 1985). Thirteen plants that are candidates for federal listing under the Endangered Species Act of 1973, as amended, are known to occur on VAFB.

Many diverse natural vegetation communities occur on VAFB. Following the California Department of Fish and Game (CDFG) Non-game Heritage Program classification of the natural communities of California (Holland 1986), they include southern foredunes, southern coastal bluff scrub, central dune scrub, central coastal scrub, Venturan coastal sage scrub, chaparral (including central maritime chaparral), coast live oak woodland and savanna, grassland, tanbark oak forest, southern bishop pine forest, and diverse wetland communities, including coastal salt marsh, freshwater marsh, riparian forests, and scrub, and vernal pools. The areal extent of each plant community on VAFB is shown in Figure 3.3.1 (VAFB Vegetation Communities). Many of these communities are of limited distribution and are considered "high priority" by the Department of Fish and Game California Natural Diversity Data Base (CNDDB).

Much of the vegetation on VAFB has been modified or otherwise disturbed by humans over the past century. Roads, USAF facilities, housing, and cropland occupy approximately eight percent of the base (Provancha 1988). Ruderal vegetation, which includes mainly introduced species, covers many extremely or repeatedly disturbed areas. Much of the remaining natural vegetation has been dissected by firebreaks and communication and utility lines. Grazing and fires are causes of disturbance to many communities on the base. Purposely or accidentally introduced exotic species such as ice plant (*Carpobrotus* sp.), Veldt grass (*Ehrharta calycina*), and pampas grass (*Cortaderia jubata*) are now dominants in some areas (Schmalzer and Hinkle 1987). In some cases, these plants are replacing rare or other native species and habitats. One introduced community, annual grassland, is commercially important for cattle grazing.

LEGEND	COMMUNITY NAME	APPROXIMATE ACRES	PERCENT OF TOTAL
	Southern foredunes	760	0.8
	Coastal scrub*	30,600	31.1
	Central dune scrub	7,700	7.9
	Venturan coastal sage sciub	3,860	3.9
	Chaparral	13,100	13.3
	Coast live oak woodland	4,350	4.4
	Grassland	18,650	18.9
	Tanbark oak forest	60	0.1
	Southern bishop pine forest	450	0.5
	Wetlands/riparian woodland	5,400	5.5
	Nonvegetation area	10,700	10.8
	Ruderal/exotic species	2,770	2.8
	TOTAL ACRES	**98,400**	**100.0**



PERCENT DISTRIBUTION OF VEGETATION COMMUNITIES AT VAFB

*Coastal scrub includes southern coastal bluff scrub, central coastal scrub, and grassland - coastal scrub.

Reference: Provancha 1988.

FIGURE 3.3.1

VAFB VEGETATION COMMUNITIES

3.3.2 LOCAL ENVIRONMENT

For purposes of this analysis, the local environment consists of the southern portion of South VAFB within an environmental study area that incorporates the proposed Cypress Ridge and alternative SLC-6, Boathouse Flats, and Vina Terrace sites, associated utility corridors, and proposed borrow sites located off of Manzanita and Mesa Roads. Boundaries of the study area are shown in Figure 3.3.2 (Vegetation Communities, Proposed and Alternative Sites).

Descriptions of the vegetation communities found on the proposed Cypress Ridge and alternative SLC-6, Boathouse Flats, and Vina Terrace sites are based on Holland (1986) and a field inventory conducted in March and June of 1988 and March of 1989, which included surveys for special interest plants (see Figure 3.3.3, Plant Communities, Environmental Study Area). An inventory of plant species observed is included in Appendix B, Table B.1. No federal- or state-listed endangered or threatened plant species were found in the study area; none is expected to occur there.

Based on historical air photos, the vegetation on the three undeveloped sites has been subjected to grazing by cattle for at least the past 60 years. It also has been subjected to occasional fires, both intentional, for range improvement in accordance with the Wildland Fuel Management Plan (USAF 1980b), and accidental, usually as a result of sparks from passing trains (Hickson 1987). Most of the vegetation at SLC-6 was removed during facility construction prior to 1970. Complete details of the inventory and survey are provided in the SLC-7 Biological Assessment (Environmental Solutions 1989b).

3.3.2.1 Special Interest Plants

This section provides information on the appearance, past and present distribution, and habitat affinities of federal candidate plant species and other special interest plants from the study area and the proposed borrow site on Mesa Road.

Fiddleneck (*Amsinckia spectabilis* var. *microcarpa*) is a sprawling annual herb, with orange-yellow flowers that appear from February through June. It is endemic to sandy areas from Nipomo Mesa in San Luis Obispo County to near Surf, Lompoc, and Buellton (Smith 1976) and south along the coast, to at least the Boathouse Flats site in Santa Barbara County. The population series on VAFB is possibly the largest in existence (Smith 1983); however, there is no estimate of the percentage of the total population that occurs on VAFB. It is common to abundant in grassland at lower elevations throughout the study area, including the proposed site at Cypress Ridge and the

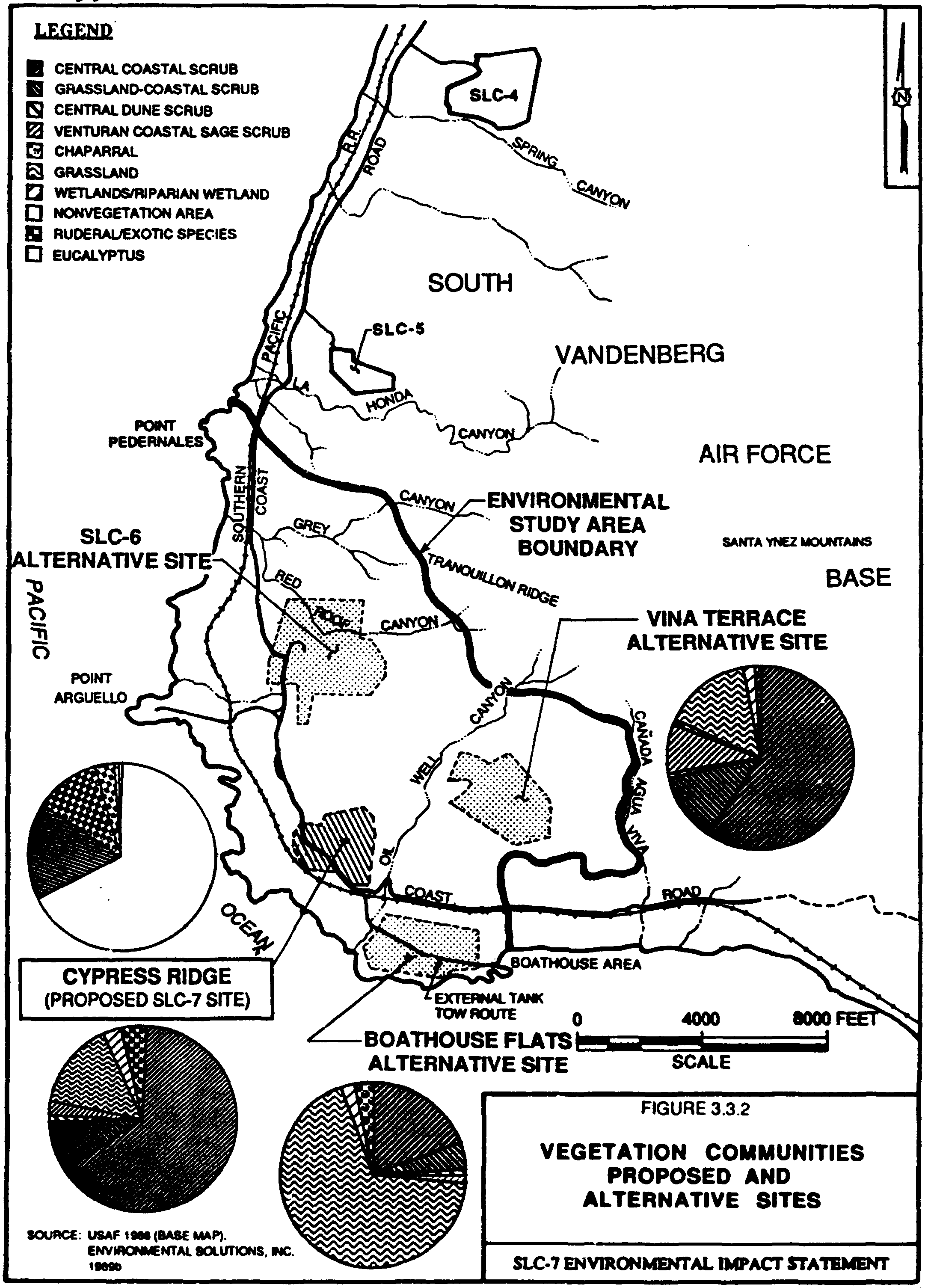
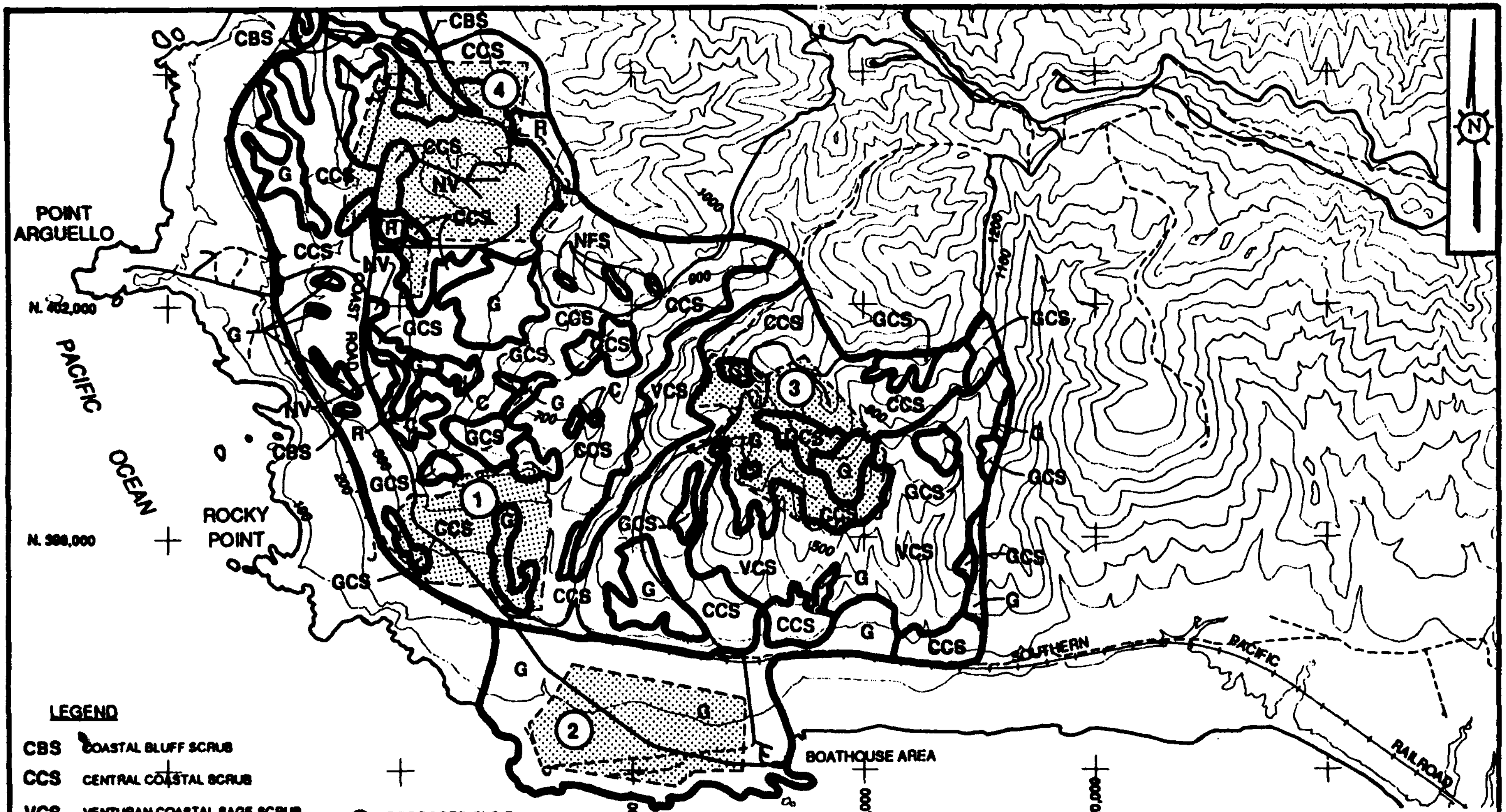


FIGURE 3.3.2

VEGETATION COMMUNITIES PROPOSED AND ALTERNATIVE SITES

SLC-7 ENVIRONMENTAL IMPACT STATEMENT



LEGEND

CBS	COASTAL BLUFF SCRUB
CCS	CENTRAL COASTAL SCRUB
VCS	VENTURAN COASTAL SAGE SCRUB
C	CHAPARRAL - MIXED AND MARITIME
GCS	GRASSLAND - COASTAL SCRUB
G	GRASSLAND
R	RUDERAL
NV	NONVEGETATION
NFS	NORTH FACING SLOPE - DOMINATED BY HUCKLEBERRY AND SALAL

SOURCE: USAF 1987d.

1 PROPOSED SLC-7 CYPRESS RIDGE SITE

2 ALTERNATIVE SLC-7 SITE BOATHOUSE FLATS

3 ALTERNATIVE SLC-7 SITE VINA TERRACE

4 ALTERNATIVE SLC-7 SITE SLC-6

0 2,500 5,000 FEET

SCALE

CONTOUR INTERVAL 100'

FIGURE 3.3.3

PLANT COMMUNITIES ENVIRONMENTAL STUDY AREA

REVISED 3/7/89

Boathouse Flats alternative site. It is less common at the proposed borrow site. The California Native Plant Society (CNPS) includes this *Amsinckia* in Appendix 1 of its Rare and Endangered Plant Inventory as a plant considered for listing, but considered too common to list (Smith and York 1984).

Purisima manzanita (*Arctostaphylos purissima*) is a shrub with smooth bark and small, white flowers that appear from November to May. It is endemic to northwestern Santa Barbara County, from Point Sal to the Purisima Hills, Burton Mesa, south to Lompoc Terrace and Cypress Ridge, and eastward in the Santa Ynez Mountains to about five miles west of Gaviota Pass (Smith 1976). It is common in central maritime chaparral on VAFB, especially on Burton Mesa and Lompoc Terrace. No estimates of population size are available. In the study area, it occurs on some ridges to the east of SLC-6, on a slope southeast of Building 520 near Venus Way, and in sandy soil on two ridges to the east of Oil Well Canyon at approximately 650 feet in elevation. It occurs on the south, east, and north edges of the proposed borrow site on Mesa Road.

Purisima Manzanita is included in CNPS Appendix 1 as a plant considered for listing, but considered too common to list (Smith and York 1984).

Shagbark manzanita (*Arctostaphylos rudis*) is a shrub that grows to five feet tall with rough, shredding bark and clusters of small white flowers that appear from November to February (Munz and Keck 1959). Smith (1976) states that it is found in sandy soil ranging from Nipomo Mesa to Corralillos Canyon, Purisima Hills, Burton Mesa, and south to Lompoc Canyon. It is locally dominant in central maritime chaparral (Davis et al. 1988). Population estimates are not available. The CDFG Endangered Plant Project is currently soliciting information on its range and population size (Howald, pers. comm. 1988). Beauchamp and Oberbauer (1977) found *Arctostaphylos rudis* at the SLC-6 site. It was not found during field work for this study. Known populations closest to the proposed Cypress Ridge site are around Lompoc Canyon (Smith 1976). Shagbark Manzanita is a Federal Category 2 candidate and is on CNPS List 1b (plants rare and endangered in California and elsewhere).

Soft-leaved Indian paintbrush (*Castilleja mollis*) is a low, multi-stemmed perennial herb with yellow to red flower bracts and soft, branched hairs on the stems. It blooms from April to August and typically grows in partly-stabilized to stabilized dunes, primarily in foredune vegetation and central dune scrub. It is endemic to at least Santa Rosa Island; the taxonomic status of the mainland plants of this species is uncertain. The mainland distribution of what has been called *Castilleja mollis* includes Pismo Beach and Guadalupe Dunes to Oceano in San Luis Obispo

County, east of Casmalia, Surf, Point Arguello, and Point Conception (Smith 1976). It shows much variation over this range (Howald et al. 1985) and appears to hybridize with *C. affinis* var. *contentiosa* in some areas. However, the population at the base of Cypress Ridge is the most variable on VAFB and is believed to be a hybrid swarm and *C. affinis*. Heckard, an authority on the genus, believes that all mainland plants are *C. affinis* (pers. comm. 1988).

There is insufficient information to estimate the size of the mainland population of the plant referred to as *C. mollis*. Smith (1983) suggested there were "thousands of plants" on VAFB, although one study yielded an estimate of 2,140 individuals on the backdunes of San Antonio Terrace alone (HDR 1980). The plants on the proposed Cypress Ridge site and in the rest of the study area do not have characteristics typical of *C. mollis* and appear to be *Castilleja affinis*. Soft-leaved paintbrush is a Federal Category 2 candidate and is included in CNPS List 1b.

Santa Barbara ceanothus (*Ceanothus impressus* var. *impressus*) is an evergreen shrub with blue flowers that bloom from March through May. It occurs from Nipomo Mesa in southern San Luis Obispo County to Burton Mesa, east to near Buellton (Munz and Keck 1959; Hoover 1970; Smith 1976), and south to the Cypress Ridge site. In the study area, it is common on the north side of SLC-6 (southwest of Building 520), on the south side of SLC-6 (near Building 369), on the north slope of Cypress Ridge (southwest of the V-33 building), and scattered in the recently burned area of the Cypress Ridge site, where there are fewer than 10 plants. Santa Barbara ceanothus often dominates some areas in chaparral for approximately 10 to 15 years after a fire (Davis et al. 1988); beyond that it is replaced by longer-lived chaparral species. It may be locally common in the study area as a result of a large wildfire that occurred in 1977 and a controlled burn conducted in 1983 (Hickson 1987); it will possibly reestablish in greater numbers in the burned area of the Cypress Ridge site. It is also scattered on the edges of the existing borrow site on Mesa Road, possibly favored by past soil disturbance. This endemic ceanothus is included in CNPS Appendix 1 as a plant considered for listing, but considered too common to list.

Western dichondra (*Dichondra occidentalis*) is a creeping perennial herb that flowers at or below the soil surface from March to May and occurs in coastal scrub, chaparral, and oak woodland from coastal Ventura County to Baja California and on some California islands (Munz and Keck 1959; Smith and York 1984). The distribution and population size in Santa Barbara County are unknown. This dichondra is common on the upper slopes of the proposed Cypress Ridge site and infrequent on the alternative Vina Terrace site. There are no records of it on VAFB outside of the SLC-7 environmental study area (Schmalzer and Hinkle 1987). Western dichondra is included in CNPS List 4, a watch list of plants of limited distribution.

Saint's daisy (*Erigeron sanctarum*) is a small herb with purple flower heads that bloom from May through July. It is endemic to coastal San Luis Obispo County, Santa Barbara County, and Santa Rosa Island, often associated with chaparral and central coastal scrub. It is known from Burton Mesa on VAFB (Smith 1983; Schmalzer and Hinkle 1987; D'Antonio, pers. comm. 1988); there are no estimates of its total population size on the base. A small population (roughly 20 plants) was found in the study area on a ridge to the northeast of the Cypress Ridge site, approximately 6,000 feet north of the Southern Pacific Railroad crossing of Oil Well Canyon. Saint's Daisy is included in CNPS List 4, a watch list of plants of limited distribution.

Large-leaved wallflower (*Erysimum suffrutescens* var. *grandifolium*) is a perennial herb with sprawling branches and yellow flowers. It occurs in coastal bluff scrub and dune scrub, occasionally in coastal scrub in some areas along the South Coast of Santa Barbara County, from near Point Arguello to Point Sal, and to Morro Rock in San Luis Obispo County (Smith 1976). No population estimates are available for this plant. It is scattered in the central coastal scrub on the northern part of the Cypress Ridge site east of the Coast Road. Large-leaved wallflower is included in CNPS List 4, a watch list of plants of limited distribution.

Crisp monardella (*Monardella crispa*), according to widely used identification manuals (Hoover 1970; Munz and Keck 1959), is a perennial herb with fragrant foliage, large heads of purple flowers, and stems densely covered with short, white hairs. It is found in sparsely vegetated dunes behind foredunes and on the edges of blowouts located at Point Sal and Mussel Rock, at the Nipomo Dunes, Oso Flaco Lake, and in the Dune Lakes area of San Luis Obispo County (Howald et al. 1985). There is no information on the size of the total population, although Howald et al. (1985) suggest there are "certainly hundreds and perhaps thousands" of individuals.

There is some confusion concerning the nomenclature of crisp monardella and curly-leaved monardella (*Monardella undulata* var. *frutescens*). Smith (1983) examined both types of specimens and plants from VAFB and areas to the north. He suggested that both *Monardella crispa* and *Monardella undulata var. frutescens* may be subspecies of *M. crispa*. However, current names are used in this report. Crisp monardella is a Federal Category 2 candidate and is on CNPS List 1b.

Curly-leaved monardella (*Monardella undulata* var. *frutescens*) differs from crisp monardella in having smaller flower heads and bracts, narrower leaves, and fewer hairs on the stems. The primary flowering period is from May to July. It is known from the Cypress Ridge area to near

Oceano in San Luis Obispo County (C. Smith 1976; D. Smith 1983). This plant requires open, sandy habitat to become established and, therefore, is found primarily in partially-stabilized dunes and other disturbed, sandy areas. It cannot withstand persistent disturbance, however, such as from off-road vehicle use.

On VAFB, curly-leaved monardella occurs in backdunes and some disturbed areas, primarily along the coast, including the dunes at Casmalia Beach, near Purisima Point, immediately to the north of Surf, and from just south of Surf to Honda Canyon (Smith 1983; CNDDB, pers. comm. 1988; R. Nichols, pers. comm. 1988). It also occurs on the San Antonio Terrace dune system, on Burton Mesa, and at Cypress Ridge in disturbed central coastal scrub and along sandy roadsides. There are no estimates of the total population size, although Smith (1983) thought the plant was moderately abundant in some areas. In a study of the San Antonio Terrace backdunes, east of the railroad tracks, an estimate was made of roughly 950,000 individuals (HDR 1980). A population of more than 200 individuals was noted near SLC-4 (USAF 1987a). Counts taken during this study of populations south of Honda Canyon yielded a total of approximately 1,600 to 1,800 plants greater than six inches in height; many more seedlings were observed.

The individuals on and near the Cypress Ridge site probably represent the southern limit of the range of *Monardella undulata* var. *frutescens*; the CDFG CNDDB and local herbaria have no records of it south of Cypress Ridge. Curly-leaved monardella is a Federal Category 2 candidate and is on CNPS List 1b.

Black-flowered figwort (*Scrophularia atrata*) is a tall, perennial herb with small, dark maroon flowers that bloom from April to June. It is endemic to coastal San Luis Obispo County and northern Santa Barbara County, although its exact range is in question because it apparently hybridizes extensively with California figwort. Smith (1983) studied *Scrophularia* on VAFB in detail and found that most populations showed evidence of hybridization. Small populations with flower characteristics close to black-flowered figwort were found in the study area in Southern Canyon, east of SLC-6, and along Coast Road, north of the road to Point Arguello. Black-flowered figwort is a Federal Category 2 candidate and is on CNPS List 3 as a plant about which more information is needed.

3.3.2.2 Cypress Ridge

The Cypress Ridge site covers approximately 120 acres and includes four vegetation communities, including central coastal scrub, grassland (predominantly nonnative grassland), and Venturan coastal sage scrub. In addition, some areas have sparse shrub cover, with openings dominated by grasses and herbs; they are classified as grassland - coastal scrub in this analysis. Ruderal vegetation occurs along Coast Road and around the Monterey cypress trees (*Cupressus macrocarpa*) west of Coast Road. Small amounts of riparian wetland occur on the southwestern area of the site. Table 3.3.1 (Approximate Distribution of Vegetation, Proposed and Alternative Sites) shows the plant communities and the area each community occupies, including proposed utility corridors. Figure 3.3.2 shows the proportion each community occupies within the site area.

The most extensive community within the Cypress Ridge site is central coastal scrub, covering approximately 85 acres. This community is characterized by a dense cover of shrubs approximately three to five feet in height. Dominant shrub species include mock heather (*Haplopappus ericoides*), coastal sagebrush (*Artemisia California*), black sage (*Salvia mellifera*), bush monkey flower (*Mimulus aurantiacus*), and coyote brush (*Baccharis pilularis* ssp. *consanguinea*). Small openings and disturbed areas are inhabited by such sub-shrubs as golden yarrow (*Eriophyllum confertiflorum*) and cudweed aster (*Corethrogyne filaginifolia*), and such annual and perennial herbs as bedstraw (*Galium* sp.), *Chorizanthe* sp. and everlastings (*Gnaphalium* spp.).

Special interest species that occur in the central coastal scrub community at Cypress Ridge include large-leaved wallflower, primarily on the upper slopes east of Coast Road, western dichondra, common on upper slopes of site, and Santa Barbara ceanothus, with a few scattered individuals on the upper slopes.

Some central coastal scrub on the proposed site is transitional to central dune scrub, particularly where the sandy soil has been disturbed. These areas are devoid of introduced ice plants (*Carpobrotus edulis* and *Conicosia pugioniformis*) and Veldt grass (*Ehrharta calycina*), which are common elsewhere on VAFB in similar situations.

In this transitional community at Cypress Ridge, a population of over 650 mature individuals (greater than six inches tall) of the Federal Category 2 candidate species curly-leaved monardella (*Monardella undulata* var. *frutescens*) occurs along two old roads just east of Coast Road, and small populations of between 10 and 60 plants are scattered in openings in central coastal scrub

TABLE 3.3.1

APPROXIMATE DISTRIBUTION OF VEGETATION PROPOSED AND ALTERNATIVE SITES

PLANT COMMUNITY	PRIMARY SITE (ACRES)	UTILITY CORRIDORS (ACRES)	TOTAL (ACRES)	PERCENT PLANT COMMUNITY DISTURBED
CYPRESS RIDGE				
Venturan coastal sage scrub	4.5	0.0	4.5	2.4
Grassland - coastal scrub	8.5	8.0	16.5	9.0
Grassland - nonnative	18.5	9.0	27.5	14.9
Ruderal	4.5	4.0	8.5	4.7
Central coastal scrub	83.5	37.0	120.5	65.0
Riparian/wetland	0.5	5.0	5.5	3.0
Central dune scrub	0.0	2.0	2.0	1.0
Chaparral	0.0	0.1	0.1	0.0
	120.0	65.1	185.1	100.0
SLC-6				
Not vegetation	140.0	Corridors in place.	170.0	61.0
Ruderal	44.0	No additional	33.0	12.0
Central coastal scrub	82.0	disturbance.	64.0	23.0
Chaparral	9.5		9.5	3.0
Maritime chaparral	1.0		3.5	1.0
Riparian/wetland	3.5			
	280.0		280.0	100.00
BOATHOUSE FLATS				
Grassland - nonnative	130.0	19.0	149.0	68.0
Grassland - coastal scrub	0.0	10.0	10.0	4.6
Ruderal	0.0	8.0	8.0	3.6
Riparian/wetland	0.0	5.0	5.0	2.2
Central coastal scrub	0.0	42.0	42.0	19.1
Central dune scrub	0.0	2.0	2.0	1.0
Venturan coastal sage scrub	0.0	3.0	3.0	1.4
Chaparral	0.0	0.1	0.1	0.1
	130.0	89.1	219.1	100.0
VINA TERRACE				
Central coastal scrub	90.0	60.0	150.0	59.2
Grassland - nonnative	25.0	14.0	39.0	15.4
Grassland - coastal scrub	20.0	11.0	31.0	12.2
Venturan coastal sage scrub	15.0	7.0	22.0	8.7
Ruderal	0.0	2.0	2.0	0.8
Chaparral	0.0	2.0	2.0	0.8
Riparian/wetland	0.0	5.0	5.0	2.0
Central dune scrub	0.0	2.0	2.0	0.8
Not vegetation	0.0	0.2	0.2	0.1
	150.0	103.2	253.2	100.0

throughout the site (see Figure 3.3.4, Locations of Curly-leaved Monardella and Crisp Monardella on VAFB and Figure 3.3.5, Environmental Study Area, Colonies of *Monardella* var. *Frutescens*). Approximately 800 to 1,000 mature plants, and many more seedlings, occur on the Cypress Ridge site. The populations on and near this location represent their southern limit (Smith 1976; Howald et al. 1985). Some plants appear to be what has been identified by an expert in the genus (Jokerst, pers. comm. 1988) as a hybrid between curly-leaved monardella and another Federal Category 2 candidate, crisp monardella (*M. crispa*).

Central coastal scrub is adapted to periodic burning; many of the shrub species regenerate by crown-sprouting after fires. This is evident in the portion of the site to the east of Coast Road. Shrubs such as mock heather and black sage are vigorously resprouting in the area that was burned but not crushed, and the open areas are dominated by annual and perennial herbs (May/June 1988). These included blue dicks (*Dichelostemma pulchellum*), fairy mist (*Pterostegia drymarioides*), *Camissonia micrantha*, and *Cryptantha leiocarpa*.

Two special interest plants also were noted in the burned area: (1) western dichondra, which is commonly scattered on the upper slopes, and (2) fiddleneck, endemic to western Santa Barbara and San Luis Obispo Counties and common to abundant on the lower slopes.

Venturan coastal sage scrub occurs in the northeast portion of the proposed site, covering approximately four acres. It is characterized by a dense cover of shrubs two to five feet in height, many of which crown-sprout after fire, and is dominated by purple sage (*Salvia leucophylla*), coastal sagebrush, and bush sunflower (*Encelia californica*). The community at this site is typical of Venturan coastal sage scrub on the rest of VAFB, where it occupies approximately 3,900 acres (Provancha 1988), predominantly on the south-facing slopes to the east of the proposed site.

Nonnative grassland occupies approximately 18 acres within the proposed Cypress Ridge site. The dominant species are introduced annual grasses such as wild oats (*Avena* spp.), fescues (*Vulpia* spp.), and bromes (*Bromus* spp.). Annual herbs found in grassland include tarweeds (*Hemizonia* spp.), thistles (*Cirsium* spp.), and the wildflowers tidy tips (*Layia platyglossa*), California poppy (*Eschscholzia californica*), and sky lupine (*Lupinus nanus*). Native perennial bunchgrasses are infrequent. One special interest plant, fiddleneck, is common to abundant in the grassland. The grassland here is typical of grassland on the rest of VAFB, where it occupies approximately 19,000 acres.

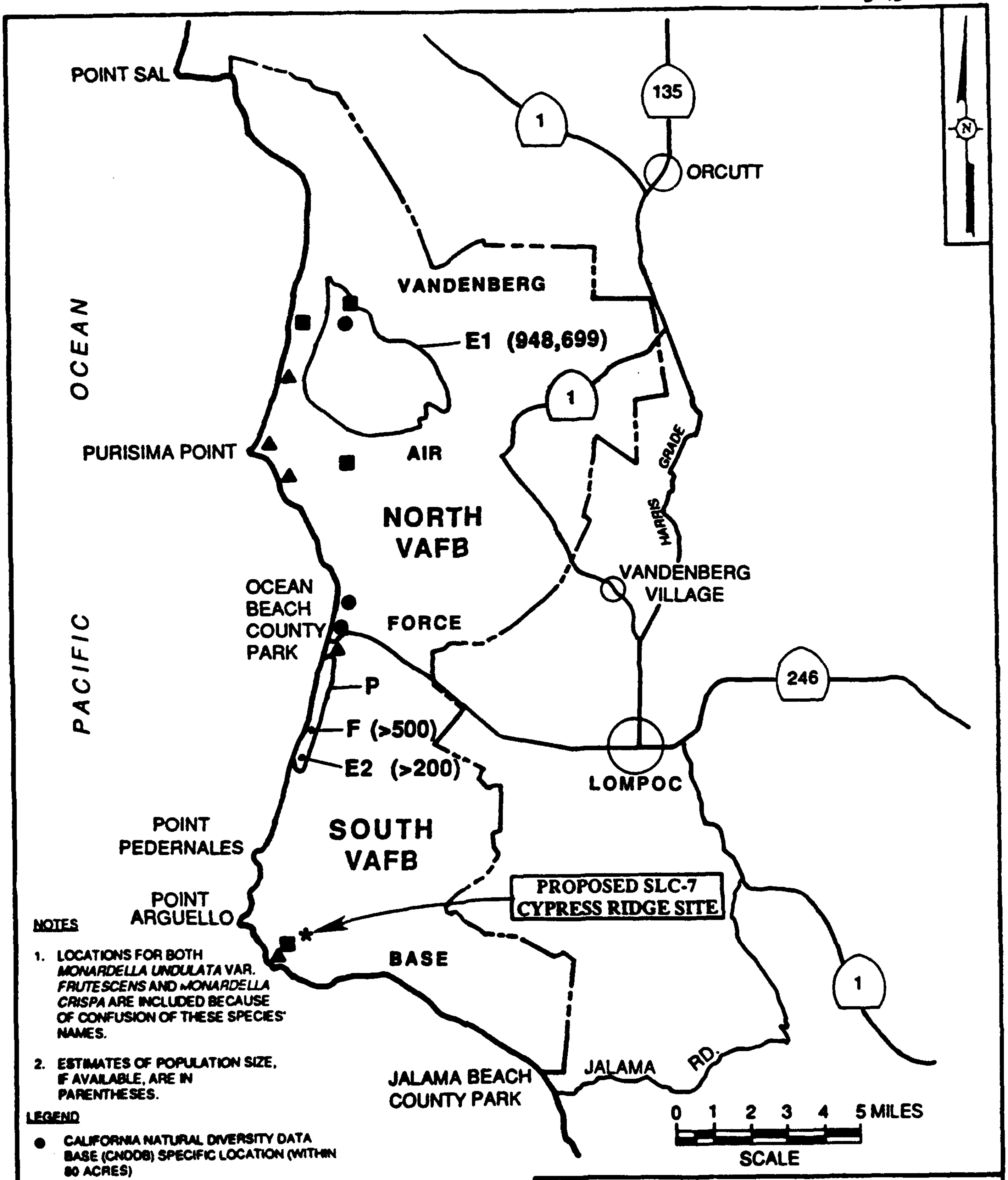


FIGURE 3.3.4

LOCATIONS OF CURLY-LEAVED MONARDELLA AND CRISP MONARDELLA ON VAFB

SLC-7 ENVIRONMENTAL IMPACT STATEMENT

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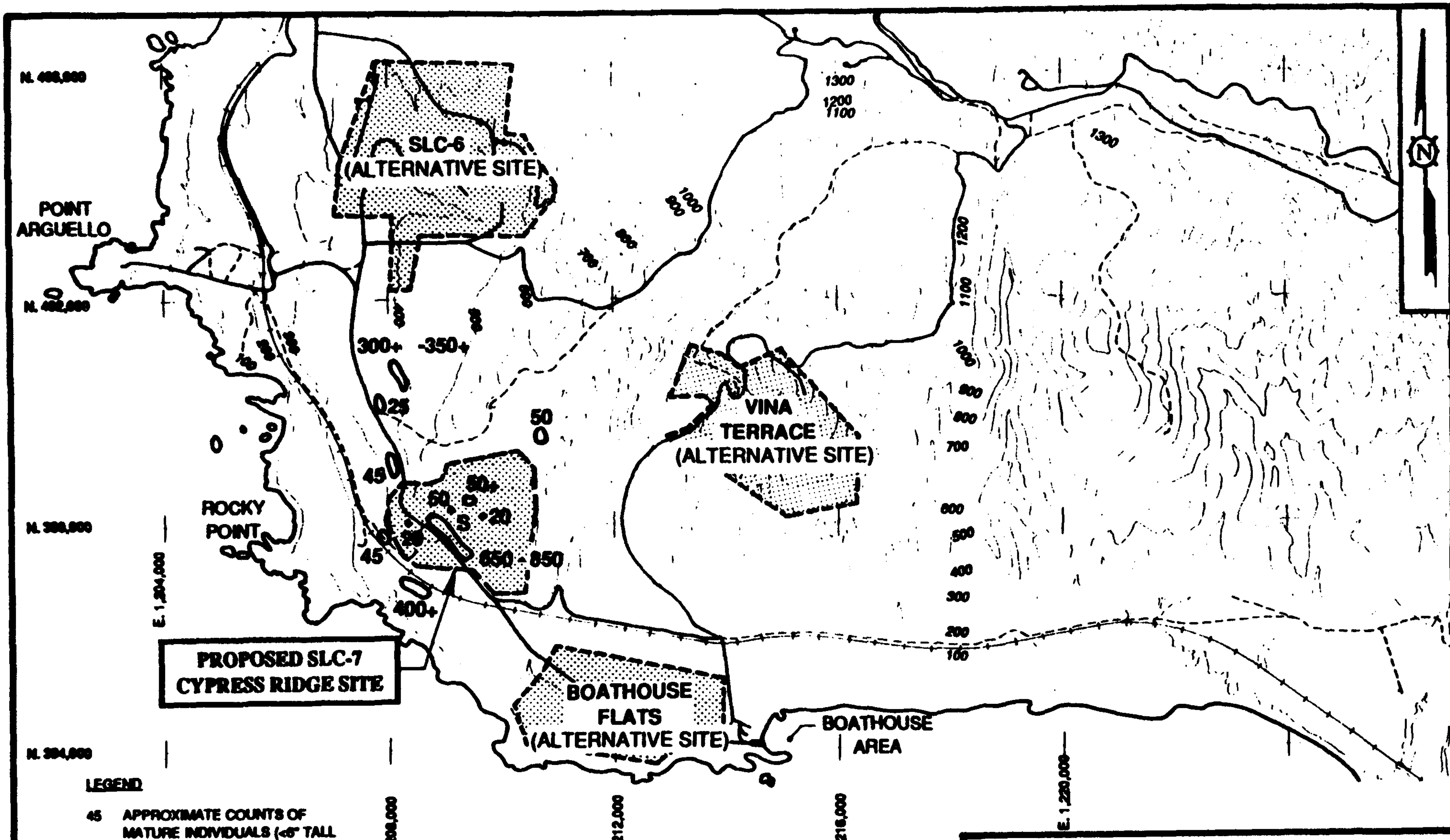


LEGEND

45 APPROXIMATE COUNTS OF MATURE INDIVIDUALS (<6" TALL OR FLOWERING) MADE DURING JUNE 1988

+ INDICATES LARGE NUMBERS OF SEEDLINGS (<6" TALL) PRESENT AT SITE

S INDICATES SCATTERED INDIVIDUALS IN AREA

SOURCE: USAF 1987d.

FIGURE 3.3.5

ENVIRONMENTAL STUDY AREA COLONIES OF MONARDELLA UNDULATA VAR. FRUTESCENS

SLC-7 ENVIRONMENTAL IMPACT STATEMENT

REVISED 4/6/88

An area of grassland - coastal scrub of approximately eight acres on the western edge of the site is characterized by widely scattered coastal sagebrush and mock heather. The native bunchgrass, purple needlegrass (*Stipa pulchra*), dominates much of the open areas within the scrub there and on the northern edge of the site east of Coast Road. The presence of this native grass is notable. The widespread destruction of native grassland habitat has led the Nature Conservancy to consider it threatened throughout its range (Jensen 1983), and the county of Santa Barbara (1979a) to consider it "an ecological community of great interest."

The eastern edge of the site is bounded by a seasonally flowing stream. The vegetation in the stream bed is dominated by coyote brush and coastal sagebrush, with occasional elderberry (*Sambucus mexicanus*).

Ruderal vegetation, characterized by disturbance-tolerant, predominantly exotic species, covers roughly four acres and occurs along the portion of Coast Road within and around the Cypress Ridge site and includes milk thistle (*Silybum marianum*), bull thistle (*Cirsium vulgare*), and annual grasses. The road cuts are dominated by introduced annual grasses, clovers (*Trifolium incarnatum, T. hirtum*), Australian saltbush (*Atriplex semibaccata*), a native lupine (*Lupinus arboreus*) used in a revegetation program in 1984 (Parsons 1984), and mustards (*Brassica* spp.).

The proposed utility corridors encompass approximately 65 acres and include seven vegetation communities, primarily central coastal scrub. The electrical corridor includes 36 acres of central coastal scrub. A population of approximately 45 mature, curly-leaved monardella plants occurs in the corridor. Two small wetlands (less than one-quarter acre each), dominated by sedges and rushes (*Carex praegracilis, Juncus balticus,* and *Juncus effusus brunneus*), occur in the corridor west of the External Tank building (Building 330). The corridor includes about four acres of riparian scrub/woodland at the Red Roof Canyon and Grey Canyon crossings, dominated by arroyo willow (*Salix lasiolepis*), with mugwort (*Artemisia douglasiana*) and poison oak (*Toxicodendron diversilobum*). Small areas of central dune scrub and chaparral also occur.

The proposed underground water supply line corridor consists of approximately seven acres and follows an existing, partially paved road. The corridor passes through central coastal scrub and grassland, including patches of *Stipa pulchra*-dominated grassland. Proposed underground communication cables, a gaseous nitrogen line, and an easement area for a future natural gas line follow existing roads through primarily ruderal vegetation.

3.3.2.3 SLC-6

The SLC-6 alternative site covers approximately 280 acres and includes central coastal scrub, ruderal, chaparral, riparian/wetlands, eucalyptus, and nonvegetation areas. Because the SLC-6 site is developed, a major portion of the area does not contain vegetation. The nonvegetation area includes the launch complex area located inside the security fence, wastewater treatment plant and evaporation ponds, sewage treatment plant and evaporation/percolation ponds, the facilities associated with the SRB refurbishment, earthen parking lot, construction laydown area, POV parking lot, paved and unpaved road, and other smaller facilities located throughout the site area. The nonvegetation area accounts for about 50 percent (140 acres) of the total site area. No federal- or state-listed threatened or endangered plants or candidate species are known to occur at the SLC-6 site.

Ruderal vegetation, characterized by disturbance-tolerant, predominantly exotic species, covers about 44 acres of the site. It occurs in the vicinity of the security fence, roads, and evaporation ponds. The ruderal vegetation at SLC-6 consists primarily of introduced grasses. Other vegetation on the site includes about 82 acres of central coastal scrub, 9.5 acres of chaparral, one acre of maritime chaparral, and about 3.5 acres of riparian/wetlands and eucalyptus.

The area inside the security fence consists of about 100 acres, most of which (70 acres) is developed with facilities related to the Space Shuttle. The other approximately 30 acres contain central coastal scrub (18 acres), ruderal species (11 acres), and maritime chaparral (one acre).

Access to the site is gained from Coast Road and then via existing roads located within the site area. Because the SLC-6 site is developed, no additional utility corridors or access roads would be needed.

3.3.2.4 Boathouse Flats

Nonnative grassland is the only community found on the 130-acre Boathouse Flats site. It is similar to that described for Cypress Ridge, but with scattered coyote brush, coastal sagebrush, goldenbush (*Haplopappus squarrosus*), and herbs, including vetch (*Vicia* sp.) and locoweed (*Astragalus nuttallii*). The slopes of the Space Shuttle External Tank Tow Route bisecting the site have revegetated since construction, with fescues, tarweeds, and Australian saltbush (*Atriplex semibaccata*). Some rockier soils in the northern portion of the site have purple needlegrass

growing on them. However, these areas are not extensive. No federal- or state-listed threatened or endangered plants or candidate species were observed at the Boathouse Flats site. Fiddleneck, a special interest plant, is scattered at the site.

The proposed road and utility corridors cover approximately 90 acres. Corridors for communication, gaseous nitrogen, natural gas, and electric power are the same as those proposed for the Cypress Ridge site, with an extension to the Boathouse Flats site, primarily through grassland and central coastal scrub. The proposed underground water line corridor passes through Venturan coastal sage scrub, central coastal scrub, and grassland, paralleling an existing patrol road over part of the distance. It crosses an area of willow- and coyote brush-dominated riparian scrubland at Oil Well Canyon.

3.3.2.5 Vina Terrace

The Vina Terrace alternative site covers approximately 150 acres and includes central coastal scrub, Venturan coastal sage scrub, grassland - coastal scrub, and grassland similar to Cypress Ridge. Approximately 90 acres are occupied by central coastal scrub, dominated at this site by coyote brush and coastal sagebrush. Silver lupine (*Lupinus albifrons* var. *douglasii)* is predominant on rock outcrops, and one special interest plant, western dichondra, is scattered under the shrubs. With these exceptions, the central coastal scrub at this site appears similar to that on the Cypress Ridge site.

Eleven acres of Venturan coastal sage scrub occur on the steeper slopes, and grassland covers approximately 25 acres. Both of these communities on the Vina Terrace site are similar to those occurring on the Cypress Ridge site. Grassland - coastal scrub occupies about 20 acres and is characterized by scattered shrubs, with openings dominated by annual grasses and herbs and, commonly, *Stipa pulchra.*

The proposed access road and utility and water corridors cover approximately 105 acres, beginning at Coast Road at the Lockheed Temporary Storage Facilities and heading south to the Vina Terrace site. The corridors cross areas of central coastal scrub, Venturan coastal sage scrub, grassland and, at Oil Well Canyon, willow- and coyote brush-dominated riparian scrub. There also are small occurrences of ruderal vegetation, chaparral, and central dune scrub. Some of the distance is along an existing dirt road that passes through some *Stipa pulchra*-dominated grassland. North of the Lockheed facilities, the electrical corridor and the gaseous nitrogen, natural gas, and communication corridor are the same as for the Cypress Ridge site.

No federal- or state- listed threatened or endangered plants or candidate species were found at the proposed Vina Terrace site or within the utility corridors leading to the site.

3.4 WILDLIFE

The following discussion summarizes the results of a wildlife study that was conducted for the proposed SLC-7 project during May and June 1988. The study area is the same as for Vegetation and Cultural Resources, as shown in Figure 3.3.3. Results of the study are included in the SLC-7 Biological Assessment (Environmental Solutions 1989b), which has been submitted to the USFWS and the NMFS concurrently with this Draft EIS for formal consultation in accordance with Section 7 of the Endangered Species Act and Marine Mammal Protection Act.

The proposed SLC-7 project area is located within a biogeographic boundary area between coastal southern and central California provinces. Being situated at the southern end of the Coast Ranges and at the western end of the Transverse Ranges, this area contains a number of plants and animals that have reached their northern, southern, or western limits. For this reason, the project area is situated in a region of considerable ecological and biogeographical interest. Detailed reviews of the biology of the VAFB region can be found in a number of previous studies (Coulombe and Cooper 1976; Coulombe and Mahrdt 1976) and in environmental documents prepared for projects on VAFB (USAF 1976b, 1977, 1978, 1987a; Engineering Science 1987; Versar 1987; Howald et al. 1985). Baseline habitat descriptions presented herein summarize information from these previous studies and environmental documents. The recent Environmental Assessment for the SLC-4 area on South VAFB (Versar 1987; Engineering Science 1987) contains baseline data that is directly applicable to habitats in the proposed SLC-7 project area. There are no previous environmental documents that provide site-specific information on the terrestrial biota and habitats of the proposed Cypress Ridge project site and its alternatives.

3.4.1 REGIONAL ENVIRONMENT

3.4.1.1 Regionally Rare and Declining Wildlife Species

A number of wildlife species recorded as declining in Santa Barbara County are known to occur within the study region. While these species have no formal legislative protection, they may be granted protection in the future if their populations continue to decline. Also, it is USAF policy to protect candidate species, if feasible. Many of the bird species that fall into this category are listed as "of special concern" by the California Department of Fish and Game, are on the "Blue List" published by the National Audubon Society, or have been found by local biologists to be rare or

declining in the Santa Barbara region. There are 18 species of birds and two species of mammals listed in Appendix B, Table B.5, that fall into this category and are known or suspected to occur in the region.

3.4.1.2 Marine Birds

The waters in the study region represent one of the most important seabird use areas in California. The abundance and diversity of the marine avifauna are due to the presence of the Channel Islands, the Santa Barbara Channel's position along the Pacific Flyway, and the occurrence of a boundary zone between warm southern and cold northern/offshore water masses within the study region. In the study region, seabirds tend to be most abundant in fall and least abundant in spring, while species diversity is highest in winter and lowest in summer. The seabird fauna of the study region tends to be dominated by nonbreeding (visiting) species. Appendix B, Table B.9, contains a listing of the species that would be expected to occur with some regularity in the study region.

The open ocean waters off the coast of central and southern California can be divided into three distinct zones based primarily on water depth: (1) continental shelf (0 to 199 meters), (2) continental slope (200 to 1,999 meters), and (3) offshore (greater than 2,000 meters). Each of these zones tends to have its own representative avifauna. Only the continental shelf habitat will be addressed in this review, as the other two are outside the study region. The continental shelf tends to be the most biologically productive of these zones and thus the most important to seabirds, with 10 to 30 species known to frequent these waters. Large numbers of Arctic loons, sooty shearwaters, red and red-necked phalaropes, and Bonaparte's gulls pass across the shelf waters during their annual spring and fall migrations. This area is especially important as a feeding area for seabirds during the fall.

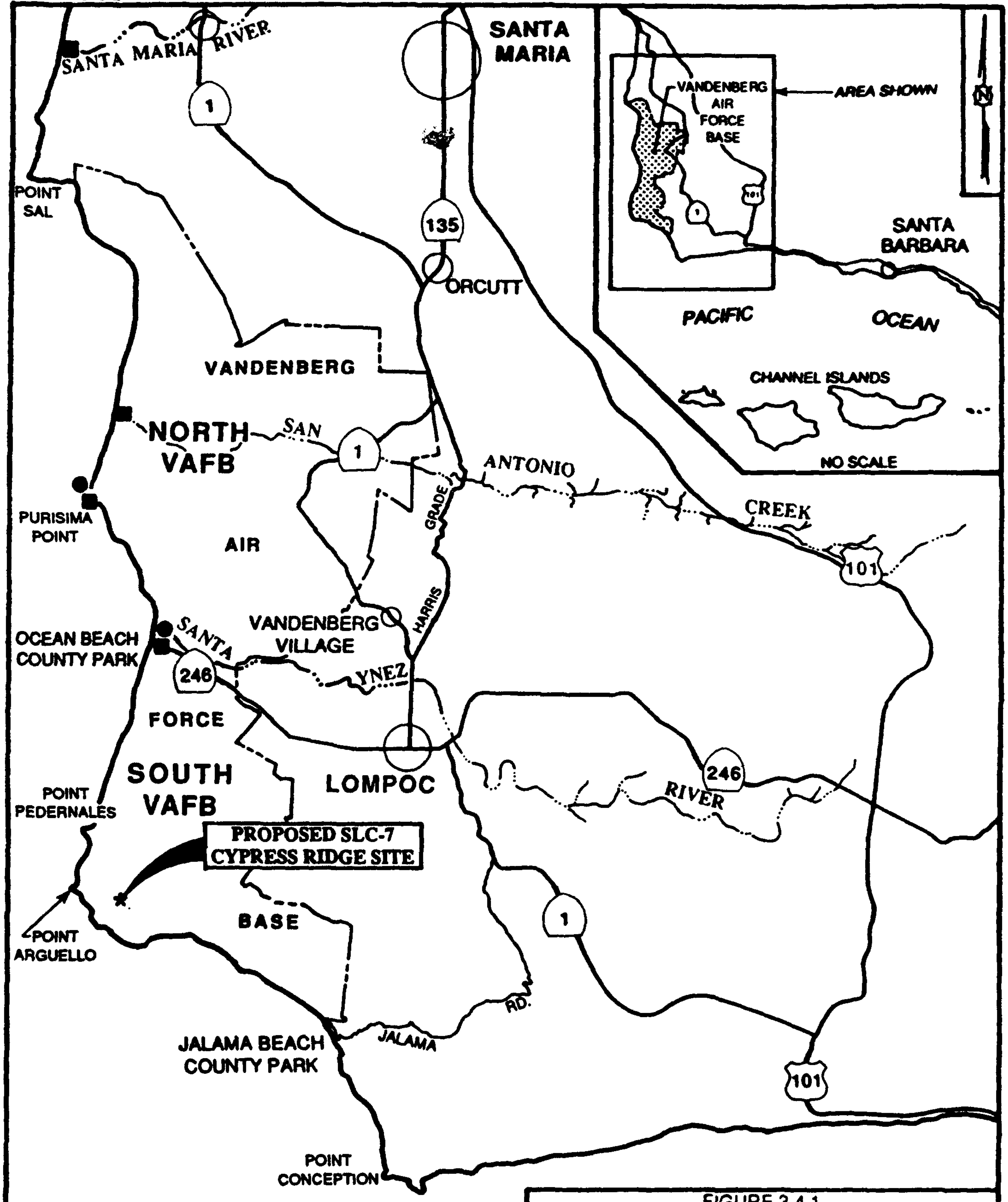
Nearshore waters (within about one-half mile of shore) tend to be used as loafing and foraging areas by loons, grebes, cormorants, scoters, phalaropes, gulls, terns, and some alcids during all seasons of the year, with peak numbers occurring during the spring and summer. During the fall and spring migration periods, a large percentage of the populations of loons, brant, scoters, gulls, and terns that winter south of Point Conception pass through this area. Gulls, cormorants, and brown pelicans predominate during the summer and fall, with cormorants most abundant in winter, and gulls and western grebes most abundant in spring. During the winter, large flocks of gulls and terns can be found on local beaches.

Rocky shorelines, which include rocky cliffs, offshore rocks and islets, and rocky intertidal areas, are used by pelicans, cormorants, and gulls for roosting and nesting, and by a variety of shorebirds for foraging. Significant rocky shoreline habitat occurs around the northern Channel Islands and in a somewhat disjunct form on the mainland in the Point Conception and Rocky Point to Point Pedernales areas. Cormorants, brown pelicans, and a variety of gulls are known to utilize the breakwater at the Point Arguello former U.S. Coast Guard Rescue Station during the fall and winter for roosting. Sowls et al. (1980) estimated that approximately 1,000 pairs of four species of seabirds nested at four sites from Point Conception to Point Arguello, including Rocky Point, Point Arguello, and Point Pedernales.

Sandy beach habitat is widespread on the northern Channel Islands and in the Point Conception to Point Arguello area. Moderately-sized coastal dunes occur on North VAFB from Minuteman Beach south to the mouth of the Santa Ynez River. Sizeable numbers of shorebirds, along with a number of species of gulls and terns, are known to frequent sandy beaches in the study region and project area for foraging and roosting. The only species known to breed in sandy beach and backdune habitats in the region include horned lark, Brewer's blackbird, and house finch (Lehman 1982). In addition, the federal- and state-listed endangered California least tern (*Sterna antillarum browni*) and the Federal Category 2 candidate, Western snowy plover, are known to utilize this habitat exclusively for nesting. Within central California, least terns are known to nest along beaches in Santa Barbara and Ventura Counties at locations ranging from Guadalupe Dunes south to Point Mugu (see Appendix B, Table B.6). In northern Santa Barbara County, least terns are known to nest near the mouth of the Santa Maria River and on VAFB at the mouth of the Santa Ynez River, Purisima Point, and San Antonio Creek (USAF 1987a). The snowy plover winters and breeds on beaches from Point Conception to Point Sal, as well as the Channel Islands and, like the least tern, could frequent sandy beaches in the project area. Snowy plovers are known to nest on San Nicolas, Santa Rosa, and San Miguel Islands, and on VAFB near the mouth of the Santa Ynez River and at Purisima Point (Page and Stenzel 1981). Known nesting sites of these sensitive species on VAFB and in the vicinity are shown in Figure 3.4.1 (Nesting Locations of California Least Tern and Western Snowy Plover).

3.4.1.3 Marine Mammals

The region of the California coast that incorporates Point Arguello, Point Conception, the northern Channel Islands, and related offshore waters contains one of the world's most diverse marine mammal assemblages. One marine mustelid (sea otter), six species of pinniped, and 25 to 30 or



NESTING LOCATIONS

● WESTERN SNOWY PLOVER

■ CALIFORNIA LEAST TERN

0 1 2 3 4 5 MILES

SOURCES: USAF 1987a; PAGE AND STENZEL 1981.

FIGURE 3.4.1

NESTING LOCATIONS OF CALIFORNIA LEAST TERN AND WESTERN SNOWY PLOVER

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more cetacean species may be found in the region either as resident or transitory species. The Channel Islands are a reintroduction site for the sea otter. Lists of the marine mammals expected to occur within the region are provided in Appendix B, Table B.10.

Oceanographically, the region has long been recognized as a transition zone dominated by two major water masses and influenced to a degree by a third. Within this transition zone, biological boundaries, with respect to breeding ranges, may be defined for some of the pinnipeds, and the occurrences of certain cetaceans may be generally correlated to prevailing oceanographic conditions. The region is characterized by an overlap between certain pinniped and cetacean species that extends south from more northerly climes and north fiom more southerly climes.

Nearshore waters in the vicinity (zero to five miles) of the project site are used by sea otters, harbor seals, California sea lions and, perhaps, by Northern fur seals and elephant seals. Because harbor seals tend to occur predominantly near shore, these waters may be used extensively by them as foraging grounds.

Offshore, San Miguel Island supports an extensive rookery for the pupping and breeding of California sea lions, Northern elephant seals, Northern fur seals, and harbor seals. The waters west and north of San Miguel appear to be important foraging areas for Northern fur seal and California sea lions that use San Miguel (Antonelis et al. 1987).

Any of the migratory species can be expected to pass through the oceanic region affected by the project. Hence, California sea lion males would pass through during their fall migration north as far as British Columbia and south again in the spring when they return to southern California waters and rookeries. Further offshore, migratory Northern fur seals will move through the region in the winter during their nonbreeding season.

Various species of cetaceans have the potential of passing through or residing in the vicinity (zero to five miles) of the project site for short periods (Appendix B, Table B.10). Solitary individuals and cow-calf pairs have been seen just seaward of the surf line in the area fronting the coast from the Point Arguello Boathouse breakwater to Rocky Point (Woodhouse, personal observation 1988). For the other migratory baleen whales, sightings within five miles of the mainland shore in the vicinity of Point Arguello to Point Conception have been made for blue, fin, and humpback whales.

Special status under either federal or state of California law is provided to nine marine mammals that may occur in the region. These include seven species of cetaceans (Pacific right whale, gray whale, blue whale, fin whale, sei whale, humpback whale, and sperm whale), one pinniped (Guadalupe fur seal), and one marine mustelid (California sea otter) (see Appendix B, Table B.11).

3.4.1.4 Channel Islands Wildlife

Amphibians and Reptiles

The Channel Islands are included within the study region because they occur below the overflight area predicted for the Titan IV/Centaur; potential impacts, primarily from sonic booms, may occur to various wildlife there. Seventeen species of amphibians and reptiles have been recorded on the Channel Islands. The island night lizard (*Xantusia riversiana*) is the only endemic, as well as the only federally-listed threatened, species on the islands and is confined to San Nicholas, Santa Barbara, and San Clemente Islands. The northern Channel Islands contain a depauperate herpetofauna, composed of species that are common and widespread along the adjacent mainland (Savage 1967). Only three species, the Pacific slender salamander, the Channel Island fence lizard, and the Santa Cruz gopher snake, have differentiated sufficiently to warrant subspecific recognition.

Land Mammals

As with the other terrestrial vertebrate groups, the land mammal fauna of the Channel Islands is depauperate, with 16 native species and at least 19 introduced species recorded. All of the native mice, skunks, and foxes are represented by endemic subspecies or species. The island fox (*Urocyon littoralis*), which occurs on the six largest of the Channel Islands, is the only land mammal that is endemic at the species level; it is a state-listed threatened species.

Land Birds

The avifauna of these islands is reasonably well known, with more than 320 species of birds, primarily migrant or transient visitors, recorded on the northern Channel Islands and Santa Barbara Island (Jones et al. 1985). The landbirds on the northern Channel Islands are unique in that they

represent a portion of the species that inhabit similar habitats on the adjacent California mainland. Of the 39 species of land birds recorded nesting on these islands, 10 are represented by endemics, the most distinctive being the Santa Cruz Island Scrub Jay.

The bald eagle and peregrine falcon are the only federal- or state-listed endangered or threatened species of landbirds which are known to frequent the northern Channel Islands. The bald eagle, formerly a resident breeder on all the islands (Kiff 1980), is now only known to visit as an uncommon to rare winter visitor (Garrett and Dunn 1981). The American peregrine falcon formerly nested on all of the islands off the coast of southern California (Kiff 1980). Today it is an uncommon to rare winter visitor to the Channel Islands. In 1988, the peregrine falcon began nesting again on San Miguel Island (Walton 1988).

Marine Birds

The Channel Islands also support regionally and nationally significant breeding colonies of 11 species of marine birds, composed of nearly 24,000 pairs. The particular association of northern and southern species found here is not duplicated anywhere else in the world. Also, these islands support the only nesting colonies of brown pelican (*Pelecanus occidentalis californicus*) along the west coast of the United States. The largest seabird nesting colonies occur at San Miguel Island, where sixty percent of the seabirds recorded nesting in the Channel Islands occur. Anacapa Island possesses the second largest number of seabirds. The brown pelican, a federal- and state-listed endangered species, is known to nest regularly on west Anacapa and Santa Barbara Islands and occasionally on Scorpion Rock off Santa Cruz Island (Hunt et al. 1980).

Marine Turtles

Four species of sea turtle are known to occur in waters offshore of southern and central California. Although all nest on tropical to sub-tropical shores, some make their way into eastern North Pacific temperate waters. The leatherback sea turtle (*Dermochelys coriacea*), which nests in the tropics and in the eastern Pacific Ocean, is known from British Columbia to Chile. Locally, three beach-cast specimens have been taken by the Santa Barbara Museum of Natural History from beaches bordering the mainland and island sides of the Santa Barbara Channel, although the nearest nesting beaches to central California are along Mexico's Pacific coast. The leatherback is listed as endangered under federal legislation.

The loggerhead sea turtle (*Caretta caretta*) range in the eastern Pacific is from southern California to Chile. It uses the same nesting beaches as other sea turtles, and specimens have been retrieved by the Santa Barbara Museum of Natural History from the southern and central California coast. The loggerhead is considered threatened under federal legislation.

The green sea turtle (*Chelonia mydas*) range in the eastern Pacific is from the coastal United States to Chile. Nesting areas in the eastern tropical Pacific include the Galapagos Islands and the Pacific coasts of Central America and Mexico. Green sea turtles are listed as threatened under federal legislation. The Pacific Ridley sea turtle (*Lepidochelys olivacea*) ranges the tropical Pacific, with California records for the species from Monterey Bay and Humboldt County. These turtles nest on the same beaches as other sea turtle species and are listed as threatened under the Endangered Species Act.

3.4.2 LOCAL ENVIRONMENT

This section discusses terrestrial wildlife that are known or expected to occur within the mainland study area in the vicinity of the four potential project sites on South VAFB. These wildlife populations are subject to both temporary and permanent impacts from construction and operation of the proposed project, depending upon which site is chosen. Wildlife that occur on the Channel Islands is discussed in Section 3.4.1.4, Regional Environment. Potential impacts to those species would be the same for the proposed action at any one of the four alternative sites.

VAFB contains diverse terrestrial wildlife habitats due to the presence of up to 11 major plant communities. However, at the proposed SLC-7 site and its alternatives, wildlife is not as diverse, due to: (1) the absence or near absence of habitats known to support higher species diversities, such as coastal wetlands, riparian woodlands, Bishop pine forests, live oak woodlands, and tanbark oak Forests, and (2) the occurrence of habitats that are widespread on VAFB and which are known to contain lower species diversities, such as grasslands and three phases of coastal sage scrub, and (3) previous development of the SLC-6 alternative site.

Knowledge of habitat types is critical to an understanding of the status and distribution of wildlife species. Animals are known to adapt to a specific set of biotic and abiotic conditions which often coincide with specific plant community types. Since vegetation types are known to be significant determinants of faunal distribution patterns, vegetation type is used in this report as a meaningful unit for the description of wildlife.

Coulombe and Cooper (1976) and Coulombe and Mahrdt (1976) provide detailed descriptions of the distribution and diversity of the fauna on VAFB. Site-specific wildlife observations for the proposed Cypress Ridge project site and its alternatives are presented in the following sections. Lists of amphibians, reptiles, land mammals, and birds observed or expected to occur within the project area and study region are provided in Appendix B, Tables B.7, B.8, and B.9.

Federal- and State-listed Threatened and Endangered Wildlife Species

Within the area encompassing the proposed project sites, there are 21 species of wildlife reported or expected to occur that are federal- or state-listed as threatened or endangered, or are being considered as candidates for federal listing. Appendix B, Table B.4, lists these species, giving their federal or state status and their likely distribution in the study region. Amphibian, reptile, or land mammal species are shown on the list, but are not expected to occur within the study area. Six species of birds (California brown pelican, ferruginous hawk, American peregrine falcon, California least tern, Western snowy plover, and long-billed curlew) that are federal- or state-listed or federal candidate species are known or expected to occur in the vicinity of the proposed SLC-7 study area.

The unarmored three-spine stickleback (*Gaterosterus aculeatus williamsoni*), a federal- and state-listed endangered species, is a naturally-occurring species in San Antonio Creek on North VAFB and is protected in accordance with the Endangered Species Act of 1973. This species has also been introduced into Honda Creek on South VAFB, about three miles north of the proposed Cypress Ridge site. Detailed species accounts for each of the federal- or state-listed wildlife species likely to occur near the SLC-7 study area are presented in Appendix B, Table B.4.

3.4.2.1 Cypress Ridge

Predominant wildlife habitat types present at the Cypress Ridge site and its associated utility corridors include: (1) southern coastal bluff scrub, (2) coastal scrub, (3) chaparral, and (4) grassland. These habitats are widespread and abundant in the region and are not known to support any threatened or endangered wildlife species. Aside from an occasional transient wintering peregrine falcon flying over, there are no threatened or endangered species of wildlife expected to frequent the vicinity of the proposed Cypress Ridge site. However, some regionally rare or declining species (as determined by local biologists) are known to frequent the habitats found on the Cypress Ridge site (see Appendix B, Table B.5).

In general, the wildlife community present tends to be composed of common, wide-ranging species that tend to frequent a variety of habitat types found throughout the study region and project area. These habitats support a suite of ubiquitous species, such as Western fence lizard, Western rattlesnake, white-crowned sparrow, Botta's pocket gopher, and deer mouse. Wide-ranging birds of prey, like the red-tailed hawk and American kestrel, along with large, wide-ranging carnivores, such as coyote, raccoon, and bobcat, are known to forage in all the vegetation types found at the Cypress Ridge site.

Wildlife of Southern Coastal Bluff Scrub

The lack of cover, coupled with the limited availability of food, combine to result in coastal bluff scrub supporting a relatively depauperate vertebrate fauna. Characteristic species that are expected to occur near the Cypress Ridge site include the Western fence lizard, gopher snake, American kestrel, California ground squirrel, and brush rabbit. The more common wide-ranging carnivores are expected to forage in this habitat. An inclusive list of species observed or expected to occur is contained in Appendix B, Tables B.7, B.8, and B.9.

Regionally rare and declining bird species expected to occasionally forage over this habitat type include black-shouldered kite (*Elanus caeruleus*), Northern harrier (*Circus cyaneus*), Cooper's hawk (*Accipiter cooperii*), Merlin (*Falco columbarius*), prairie falcon (*F. mexicanus*), and burrowing owl (*Athene cunicularia*). Only the Northern Harrier has been observed at the Cypress Ridge site foraging in the scrub community (Appendix B, Table B.9).

Wildlife of Coastal Scrub (Includes central coastal scrub and Venturan coastal sage scrub)

As many as 12 species of reptiles have been found to inhabit the three serial stages of coastal scrub habitat on VAFB. Western fence lizard, California legless lizard, Western skink, and Western rattlesnake are some of the more common species. Amphibians are uncommon in this dry environment and generally occur only during the winter months. No threatened, endangered, Federal Category 2 listed, or regionally rare or declining amphibians or reptiles are expected to inhabit coastal scrub habitats in the project area.

There are no threatened or endangered species of birds known or expected to frequent coastal scrub habitats in the project area. Ferruginous hawk (*Buteo regalis*), a Federal Category 2 candidate

species, can be expected to forage over this habitat during the fall and winter. Various regionally rare and declining bird species are expected to forage in this habitat, including black-shouldered kite, Northern harrier, Cooper's hawk, Merlin, prairie falcon, burrowing owl, and short-eared owl (*Asio flammeus*). Other species of birds known or expected to occur are listed in Appendix B, Table B.9.

Coastal scrub is an important habitat for mammals, with 14 species of rodents and nine mammalian predators known or expected to occur (see Appendix B, Table B.8). The dense cover makes it an ideal habitat for small mammals, which in turn are prey for a number of resident carnivores and birds of prey. There are no threatened or endangered species of mammals expected to occur in coastal scrub habitats on the proposed site. Badger (*Taxides taxus*) is the only regionally rare or declining species of mammal known or expected to occur. Active sign of badger was observed in this habitat type on the Cypress Ridge site during field inventories conducted in the spring of 1988 (Environmental Solutions 1989b).

Wildlife of Chaparral (includes northern mixed chaparral/central maritime chaparral and blue brush chaparral)

Amphibian diversity in chaparral is relatively low because of its arid character, with blackbelly slender salamander, ensatina, and Pacific tree frogs known to occur during the winter. In contrast, a number of reptiles are known to inhabit the dense stands of brush typical of chaparral communities. The Western fence lizard, Western terrestrial garter snake, and Western rattlesnake are among the commonly occurring chaparral associates. No regionally rare or declining amphibians or reptiles occur in chaparral habitat near the Cypress Ridge site.

Many of the bird species characteristic of chaparral plant communities tend to be similar to those found in coastal scrub, which is often contiguous or even integrated. Regionally rare and declining bird species expected at the site include Northern harrier, Cooper's hawk, prairie falcon, and tree swallow.

Chaparral supports a reasonably diverse assemblage of mammals. Rodents are well represented, with 13 species having been recorded in Santa Barbara County chaparral (Howald et al. 1985). Because of the diversity and abundance of available rodent prey and the dense protective cover provided by chaparral, a number of large, wide-ranging carnivores, such as coyote, gray fox,

and bobcat, frequent this habitat. Mountain lion (*Felis concolor*), a fully protected species in the state of California, is the only regionally rare or declining species that is expected to occur in the vicinity of the proposed site.

Wildlife of Grassland Habitats (includes native perennial and introduced grassland communities)

Although grasslands are low in species diversity, they often support large numbers of individuals in a few vertebrate populations. The Pacific treefrog and blackbelly slender salamander are the only amphibians expected to occur commonly. Various lizards and snakes are expected, but no sensitive amphibians or reptiles are anticipated to occur in grasslands at the site.

Several species of raptors, including the black-shouldered kite, Northern harrier, and burrowing owl, rely on open expanses of grasslands for hunting. Tall grass hillsides at Point Sal and locally, south of Lompoc to Point Conception, are the last sites in Santa Barbara County known to support populations of grasshopper sparrows (*Ammodramus savannarum*), a regionally rare and declining species (Lehman 1982). Grasslands in the vicinity of the Cypress Ridge site provide essential foraging habitat for two Federal Category 2 candidate species of birds (ferruginous hawk and long-billed curlew) and nine regionally rare and declining birds (black-shouldered kite, Northern harrier, Cooper's hawk, Merlin, prairie falcon, burrowing owl, short-eared owl, tree swallow, and grasshopper sparrow). To date, only the Northern harrier has been observed foraging in grasslands at the Cypress Ridge site (Appendix B, Table B.9).

Grasslands in the project area are favored habitat for rodents and mammalian predators, including the coyote, long-tailed weasel, and badger, which are dependent on grasslands for foraging and denning sites. Places where grasslands are bordered by woodland or dense brush are excellent foraging areas for mule deer. The badger is the only regionally rare mammal known to frequent grasslands in the vicinity of the site.

Wildlife of Riparian Woodland/Wetland Habitats

Riparian woodlands/wetlands have declined throughout central and southern California during the past century and now only occur in a disjunct form along streams and rivers and in foothill canyons. In northwestern Santa Barbara County, extensive areas of riparian woodlands still

exist along the Santa Maria River west of Guadalupe, on San Antonio Creek, particularly at Barka Slough on VAFB, and along the Santa Ynez River, from its mouth east to Buellton. Within VAFB, there are approximately 5,000 acres of wetlands.

Small pockets of riparian woodland are found near Garey, along Shuman Canyon, and along Bear and Honda Creeks on South VAFB. Most of the riparian habitats on VAFB are in locales characterized by a cool climate with regular foggy periods. There are a few small pockets of willow riparian woodland habitat situated in the project area at Red Roof, Spring, and Agua Viva Canyons.

Riparian woodland and freshwater habitats support a diverse assemblage of amphibians and reptiles. The red-legged frog and Western pond turtle are the only regionally rare or declining amphibians or reptiles known to frequent freshwater wetland habitats on VAFB. Neither of these species, and no threatened or endangered species of amphibian or reptile, is expected to occur within the project area because there is not a sufficient year-round flow to sustain deeper pools necessary for their survival during the long, dry summer months.

Riparian woodlands support a diverse assemblage of resident and migrant landbirds. As a result of loss and alteration of habitat, there are a number of riparian dependent birds which have shown significant declines in their populations over the past century throughout southern California. Species like the yellow-billed cuckoo, long-eared owl, willow flycatcher, and Wilson's warbler have been completely extirpated as breeders south of Point Conception. Today, only three of these species occur in a few isolated locales in northwestern Santa Barbara County (see Appendix B, Tables B.5 and B.9). Cooper's hawk, Swainson's thrush, and yellow-breasted chat are now rare throughout much of Santa Barbara County, while warbling vireos and yellow warblers are, at present, local and uncommon as nesters in the project area. These species are addressed in greater detail as regionally rare and declining in Appendix B, Table B.5.

Twenty-nine species of mammals are expected to occur in riparian woodlands in northern Santa Barbara County (Howald et al. 1985). Coulombe and Cooper (1976) recorded a total of seven species of small mammals in riparian woodlands on VAFB. Some of the more common species known to occur include towbridge and ornate shrews, California mouse, and dusky-footed woodrat. Riparian woodlands also provide excellent foraging habitat for a number of large mammals, such as brush rabbit, bobcat, mule deer, and introduced feral pigs. Western gray squirrels are the only regionally rare or declining mammal expected to occur in riparian woodlands

on South VAFB. This species is not expected to occur in the willow woodlands within the project area due to the limited extent of this habitat. There are no threatened or endangered species of mammals expected to occur in these habitats in the SLC-7 study area.

Wildlife of Planted Windbreaks

The planted windbreaks of Monterey cypress and eucalyptus trees in the project area are important habitat for migratory landbirds. These trees act like plant islands which tend to concentrate migrant landbirds, such as flycatchers, vireos, warblers, and orioles. These planted trees provide important resting and feeding habitat for birds that have been flying long distances over the ocean. Common raptors like the red-tailed hawk, American kestrel, barn owl, and great-horned owl are known to utilize these trees for roosting and nesting. For most of the year, only a few common species tend to frequent the trees. Aside from an occasional roosting, regionally rare or declining raptor, such as ferruginous hawk, Northern harrier, Cooper's hawk or prairie falcon, no other sensitive wildlife species and no threatened or endangered species of wildlife are expected to frequent the planted trees in the project area.

Monarch Butterfly

Populations of monarch butterfly (*Danaus plexippus* [*Linnaeus*]) are known to exist in the row of Monterey cypress trees at the former U.S. Coast Guard Rescue Station situated on the bluff above the External Tank Landing Facility. They also have been recorded on Santa Rosa, Anacapa, and Santa Barbara Islands. The species has a worldwide distribution, but its western North American populations are vulnerable to heavy losses resulting from their overwintering strategy. As a consequence, the conservation of monarch butterfly overwintering sites has been designated a top priority of the Species Survival Commission of the International Union for the Conservation of Nature and Natural Resources (Nagano and Lane 1985).

During the fall months, monarchs west of the Rocky Mountains migrate west to California, while those east of the Rockies migrate south to Mexico. The number of monarchs overwintering in California is estimated at one to ten million butterflies, with populations susceptible to destruction for a variety of reasons, including real estate and agricultural development and other disturbances. The butterflies congregate in both temporary and permanent clusters, utilizing the same localities from year to year. Cluster sites typically are located close to the coast, generally within one mile of the shoreline. The sites are generally wooded, with trees of mixed sizes and an understory of

brush. The site characteristics provide both protection from wind and freezing temperatures and exposure to sunlight during cold weather, and cool, shady conditions during unusually warm days (Nagano and Lane 1985).

There are 17 monarch butterfly roosting and overwintering sites on VAFB that are fairly reliable year to year. Generally, the sites are characterized by eucalyptus groves or Monterey cypress, the presence of freely available water, and shelter from the wind. Most of these sites are located on South VAFB, primarily near the coast. They are addressed in detail in the Biological Assessment (Environmental Solutions 1989b).

Marine Mammals

Within the marine region of the proposed Cypress Ridge site, there are several areas of importance to marine mammals. The shoreline from Cypress Ridge Point Conception to north of Point Arguello supports several haul out sites for Harbor seals and, to a lesser degree, California sea lions. Occasionally, elephant seals may haul out along this section of coast, as may Northern fur seals. Harbor seals are the only pinniped species to use these hauling grounds as rookeries in the spring.

The 1986 harbor seal census from 0.8 mile east of Point Conception to Point Arguello produced a count of 1,012 animals (Hanan et al. 1987). In the vicinity of Point Arguello, pupping occurs in late March and, by mid-April, subsequent to the peak of pupping, the seals tend to congregate (Elias 1983). This may be correlated in part to the onset of breeding. The pocket beach immediately north of the mouth of Oil Well Canyon (about 0.5 mile south of Rocky Point) is a significant hauling ground and rookery for the area. Additional haul out sites occur toward Rocky Point in the rocks immediately seaward of the Point Arguello former U.S. Coast Guard Rescue Station breakwater. The 1986 census produced counts totaling 500 seals for these sites (Hanan et al. 1987).

3.4.2.2 SLC-6

About 50 percent of the area is developed (nonvegetation) with Space Shuttle launch facilities, and another 15 percent is ruderal vegetation. The remainder of the SLC-6 site is made up of central coastal scrub (29 percent), chaparral and maritime chaparral (four percent), and small riparian/wetlands and eucalyptus (one percent).

The predominant wildlife habitats in the vicinity of the SLC-6 site are central coastal scrub, ruderal vegetation, and chaparral. Wildlife species associated with the central coastal scrub and chaparral are the same as discussed for the Cypress Ridge site. Wildlife associated with the ruderal habitat would be similar to that found in the grassland area. The most common species expected to be seen at the SLC-6 site would be Western fence lizard, California legless lizard, Western skink, Western rattlesnake, Pacific treefrog, and blackbelly slender salamander, as well as such wide ranging species as coyote, mule deer, and red-tailed hawk.

No threatened or endangered species of wildlife are expected to occur. The site does, however, provide suitable foraging habitat for ferruginous hawk and long-billed curlew, two Federal Category 2 candidate species, and for a number of regionally rare and declining species, such as black-shouldered kite, Northern harrier, Cooper's hawk, Merlin, prairie falcon, burrowing owl, short-eared owl, tree swallow, grasshopper sparrow, badger, and mountain lion. All of these species could be expected to occur with uncommon but regular frequency.

3.4.2.3 Boathouse Flats

The predominant wildlife habitat present at the Boathouse Flats site and its utility corridors is degraded, introduced grasslands. Cattle grazing, along with development of the Space Shuttle External Tank Tow Route, the NASA VLB1 Tracking Station, and a series of dirt roads have reduced the value of the grasslands. Wildlife associated with grassland habitats are the same as for Cypress Ridge. The most common species observed at this project site were Western fence lizard, red-tailed hawk, European starling, house finch, and California ground squirrel.

Regionally rare and declining species that have been observed at or adjacent to the site are the black-shouldered kite, Northern harrier, prairie falcon, burrowing owl, and badger. Additional regionally rare or declining species which could occur with uncommon but regular frequency are the Cooper's hawk, Merlin, short-eared owl, and tree swallow. Excellent habitat exists for the burrowing owl and badger due to the high density of California ground squirrels present on the site. Abandoned ground squirrel burrows are used by burrowing owls, while California ground squirrels are a major prey item in the diet of badgers. The American peregrine falcon (*Falco peregrinus*) is the only federal- or state-listed threatened or endangered wildlife species likely to regularly use the grasslands of the Boathouse Flats site. However, two additional endangered species, the California brown pelican (*Pelecanus occidentalis*) and the California least tern (*Sterna*

antillarum), are known to forage in the nearshore waters adjacent to the site. The brown pelican is also known to roost in sizeable numbers on the Point Arguello Boathouse breakwater, adjacent to the site.

3.4.2.4 Vina Terrace

Predominant wildlife habitats present at the Vina Terrace site and its utility corridors include coastal scrub and introduced grasslands. Wildlife associated with these communities is the same as discussed for the Cypress Ridge site. In general, it is composed of species that are widespread and abundant in the study region, such as the Western fence lizard, Western rattlesnake, desert cottontail, Botta's pocket gopher, Costa's hummingbird, and white-crowned sparrow, as well as such wide ranging species as coyote, mule deer, and red-tailed hawk. Species observed at this project site are listed in Appendix B, Tables B.7 through B.9.

The most significant species observed on the Vina Terrace site included three regionally rare and declining species, the Northern harrier, Wilson's warbler (migrant), and badger (see Appendix B, Table B.9). The most important feature of the Vina Terrace site for wildlife is its relatively pristine condition and its remoteness. Due to controlled human access, evidence of species such as coyote, badger, and mule deer was more numerous than would be expected of a more accessible area. Aside from two seldom used roads and a buried utility line corridor, the only other evidence of disturbance at the site was that of cattle grazing.

No threatened or endangered species of wildlife are expected to occur. The site does, however, provide suitable foraging habitat for ferruginous hawk, a Federal Category 2 candidate species, and for a number of regionally rare and declining species, such as Northern harrier, Cooper's hawk, Merlin, prairie falcon, burrowing owl, grasshopper sparrow, badger, and mountain lion. All of these species could be expected to occur with uncommon but regular frequency. They are addressed in greater detail in Appendix B, Table B.5. The grassland habjtat is the most important habitat for wildlife at this site. Undisturbed grassland, like that found along the eastern edge of the site, is of the type required by grasshopper sparrows for nesting and by Northern harriers and black-shouldered kites for foraging. This kind of habitat is now very localized in distribution and has been declining throughout Santa Barbara County.

3.5 AIR QUALITY AND METEOROLOGY

3.5.1 REGIONAL ENVIRONMENT

3.5.1.1 Meteorology

Coastal Environment

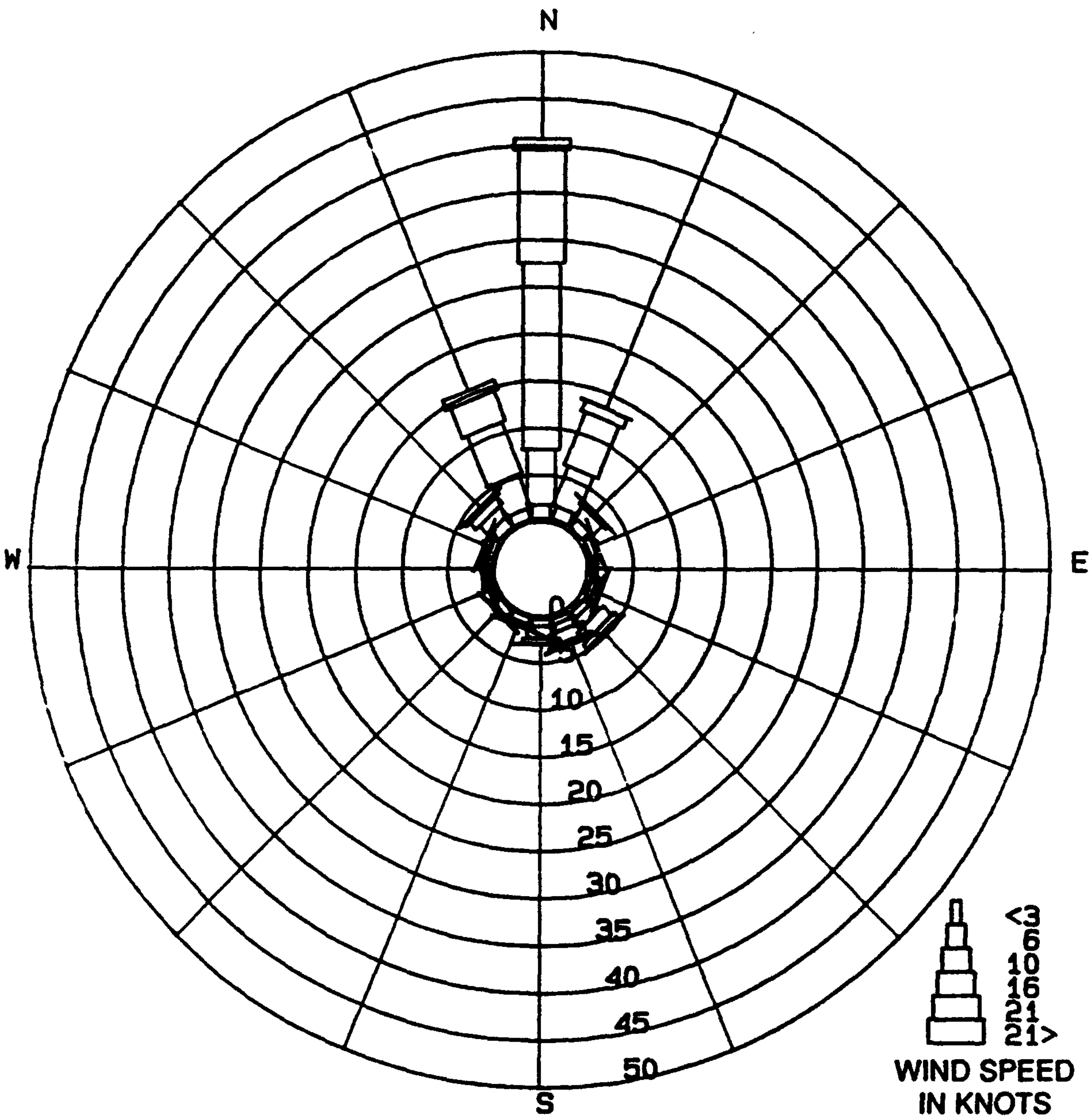
The climate in Santa Barbara County is typical for coastal south-central California and is categorized as Mediterranean, or dry and subtropical. During the summer, the area is characterized by persistent night and morning low cloudiness and fog, which results in restricted visibility. This condition often clears by afternoon, due to the onset of a mid-day sea breeze and the continued heating of the air mass.

Throughout the year, the prevailing wind direction is northwesterly and westerly. Wind frequencies measured at Point Arguello from September 1985 through April 1988 are shown in Figure 3.5.1 (Point Arguello Wind Direction and Wind Frequencies). The location of the Point Arguello and other stations are shown in Figure 3.5.2 (Regional PSD and SLAM Stations). During the fall and early winter (and occasionally during late spring and early summer), the area is subject to Santa Ana winds. These strong, gusty winds are warm and dry and travel from the inland desert through the mountain valleys and out to the ocean. High ozone levels recorded in Santa Barbara County have been attributed to Santa Ana winds, which are thought to transport ozone precursors to the area from inland sources within the Los Angeles air basin (USAF 1988b).

Wind speeds are light throughout the year and vary with the time of day. Exceptions occur along the coast, on exposed ridges, or when a strong storm or frontal system is present. Wind speeds generally increase during the day and peak in the afternoon. Sea breezes, which result from differential heating of land and sea, flow onshore during the day. Weaker land breezes flow offshore at night.

Temperatures along the coast are mild, ranging from 45 to 85 degrees Fahrenheit (°F). Temperatures below freezing and above 100°F are rare. Temperature differences on land and at sea are greater in the winter than in the summer. Greater fluctuations in temperature occur inland with increasing distance from the ocean, as well as with greater elevation.

POINT ARGUELLO PSD STATION
SEPTEMBER 1985 THROUGH APRIL 1988



WIND FREQUENCIES
ALL STABILITY CLASSES

FIGURE 3.5.1

POINT ARGUELLO WIND DIRECTION AND WIND FREQUENCIES

SOURCE: Tracer Technologies 1988.

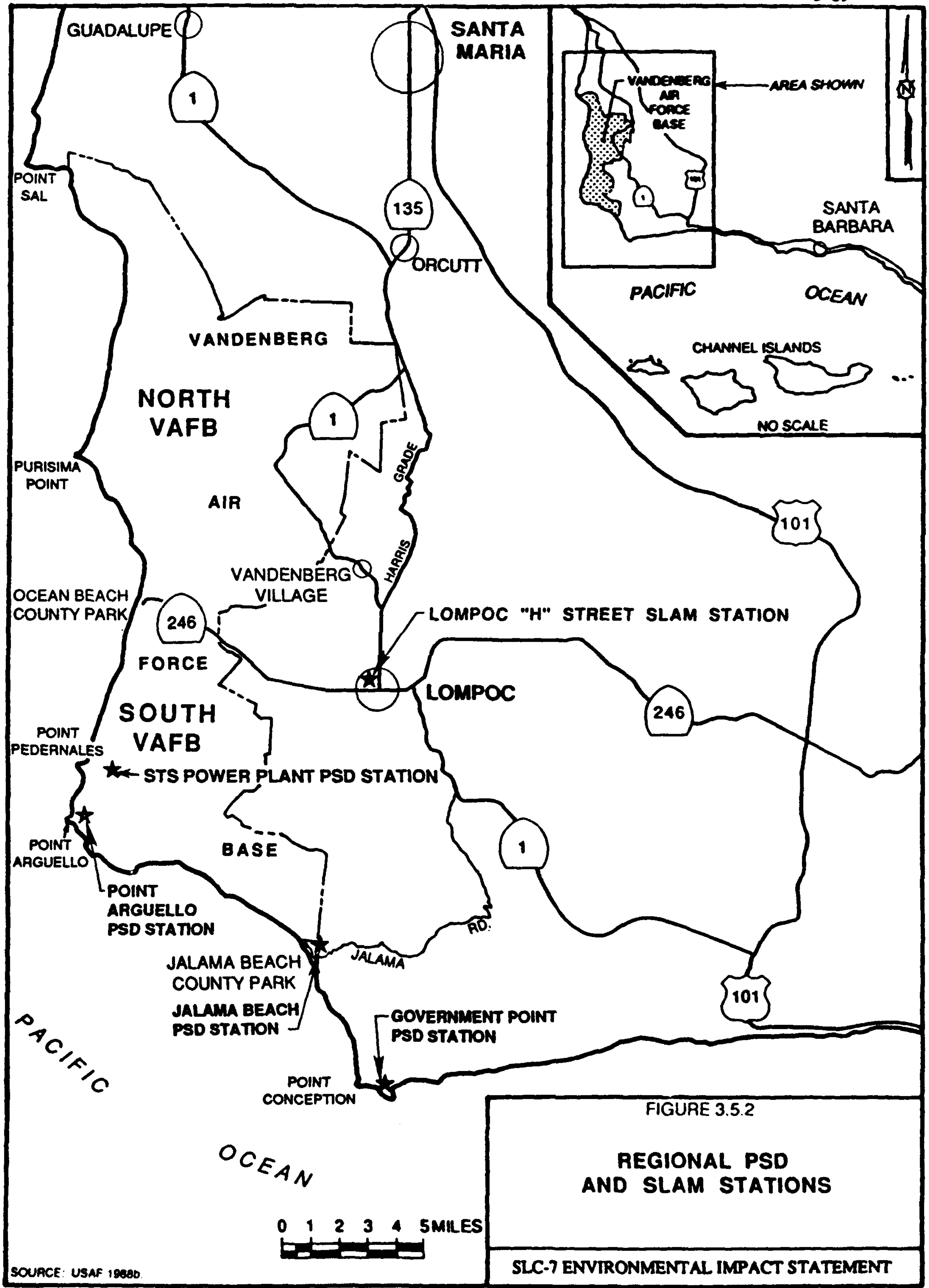


FIGURE 3.5.2

REGIONAL PSD AND SLAM STATIONS

SLC-7 ENVIRONMENTAL IMPACT STATEMENT

During the summer, the area experiences a persistent subsidence inversion, a phenomenon where cooler, more stable air lies below warmer air and results in pollutants being trapped in the area. The inversion layer limits the mixing height to less than 2,000 feet above the ground. During the remaining seasons, surface inversions form in the early morning when the ground cools more rapidly than the air above.

The wet season in southern California extends from November to April and generally consists of fair weather, with occasional cloudiness and rainshowers. Precipitation is mainly in the form of rain along the coast and in lowland areas and may occur as both rain and snow in the higher, mountainous areas. Annual rainfall averages from 10 to 30 inches, 90 percent of which occurs during the wet season. Thunderstorms average about two to three occurrences per year, most likely during winter, when storms are associated with cold fronts, and in September, with the movement of tropical moisture into the region from the south or southeast. The average annual precipitation for the VAFB region is 12.7 inches. The wettest month is usually February, when most of the extratropical storms from the southwest move inland. The mean monthly precipitation for February is 2.6 inches. July is usually the driest month, with a mean monthly precipitation of 0.01 inch.

VAFB Environment

The coastal location of VAFB results in the ocean providing a moderating influence on the temperature and moisture content of the air and a narrow range of values for these two meteorological parameters. The average annual temperature is 55°F. Mean monthly minimum temperatures range from 43°F in January to 53°F in August and September. Average maximum temperatures range from 59°F in March to 68°F in October. The mean annual relative humidity recorded at the VAFB airfield is 77 percent. Low relative humidity (less than ten percent) is occasionally experienced during the occurrence of a Santa Ana wind.

Within VAFB, widely varying terrain results in a variation of local wind speed and direction. In general, winds are stronger on the higher ridge lines, along the beaches, and on South VAFB. The average maximum diurnal wind speed at South VAFB (about 17.0 mph at 3 p.m.) is greater than at North VAFB (about 6.0 to 8.0 mph at 4 p.m.). The mean annual surface wind speed is 7.0 mph from a predominantly northwesterly direction. Mean maximum gusts of wind up to approximately 47 mph have been experienced during January, February, and March.

Reduced visibility in the VAFB region is due largely to coastal ground fog, which occurs primarily during July, August, and September. The fog is usually confined to late evening and early morning hours, but may persist in the near shore area throughout the day. Visibilities of 0.25 mile or less occur approximately five percent of the time during early morning hours.

Clouds are common in the VAFB area, averaging about 48 percent cloud cover annually and generally greater at North VAFB than at South VAFB. The average annual ceiling height is approximately 1,000 feet, depending on the base height of the inversion layer.

3.5.1.2 Air Quality

VAFB is located in the California South Central Coast Air Basin. The basin encompasses the counties of Ventura, Santa Barbara, and San Luis Obispo. Santa Barbara County is divided into North and South County, and VAFB is within North County. Air quality within this region is generally good, with the exception of intermittently high levels of: (1) ozone brought to the area from inland sources, and (2) PM_{10} (particulate matter less than 10 microns in diameter) attributed mostly to the agricultural industry in the area.

VAFB has installed and maintains an air monitoring station as part of the State and Local Air Monitoring Station (SLAMS) program established for the Santa Barbara County Air Pollution Control District (SBCAPCD). VAFB currently maintains one SLAM station in the city of Lompoc, located at "H" Street. In addition, PSD monitoring stations operated by Chevron at Jalama Beach and Government Point, by Unocal at Point Arguello, and by VAFB east of the STS Power Plant are located within the VAFB region. Figure 3.5.2 shows the locations of the monitoring stations.

Four criteria pollutants, ozone (O_3), carbon monoxide (CO), nitrogen dioxide (NO_2), and sulfur dioxide (SO_2), are monitored at the "H" Street station for compliance with national and state ambient air quality standards. The Jalama Beach station measures O_3, NO_2, SO_2, and PM_{10}, while the Point Arguello station samples O_3 and NO_2. The STS Power Plant station measures O_3, CO, NO_2, SO_2, and PM_{10}.

An area is designated as being in attainment for a particular criteria pollutant if ambient concentrations in that area are below the corresponding standard. In the past, North County has been in attainment for all criteria pollutants, with South County being nonattainment for ozone. Recently, North County exceeded national ambient air quality standards for ozone (USAF 1987a).

On October 27, 1987, the SBCAPCD made a presentation to its board of directors for redesignation of North County as a nonattainment area for ozone (USAF 1988b). For purposes of assessing compliance with applicable SBCAPCD rules, the nonattainment designation for ozone means that all new sources in North County will be required to undergo New Source Review (NSR). Best Available Control Technology (BACT) maximum emission levels for nonattainment criteria pollutants and their precursors will be limited to 2.5 pounds per hour. However, North County will continue as a federal attainment area for ozone until approval for redesignation is given by the EPA. Ozone is a secondary pollutant generated from the photochemical reaction of nitrogen oxides (NO_x) and reactive organic compounds (ROC). Thus, NO_x and ROC would also be declared nonattainment pollutants due to their precursory role in ozone formation (USAF 1988b).

North Santa Barbara County is in attainment of federal PM_{10} standards, but it is considered by SBCAPCD (1988) to be in nonattainment of state PM_{10} standards. Since the SBCAPCD considers the area in nonattainment for PM_{10}, this pollutant and its precursor, SO_x, would be regulated by SBCAPCD under NSR rules.

Data recorded on PM_{10} at Santa Maria indicate that the 1986 annual geometric mean was 29.3 ug/m^3 and that the highest and second highest measured 24-hour average concentrations were 73 and 65 ug/m^3, respectively. A review of the air quality data and a comparison with state and federal standards indicate the exceedance of the state ozone standard (0.10 ppm, 1-hour average) and the state PM_{10} 24-hour standard (50 ug/m^3). The measured PM_{10} 1986 annual geometric mean is only slightly less than the state standard of 30 ug/m^3.

Air quality data from existing stations have been used to establish the baseline upon which impacts from the proposed action have been assessed. These stations were selected to represent air quality of the relatively remote location of the areas under consideration for siting of the proposed SLC-7 operational facilities. Figure 3.5.2 shows the location of the chosen stations. Table 3.5.1 (Measured Air Quality Data Summary, VAFB and Vicinity) summarizes air quality data from the Point Arguello, Jalama Beach, and the STS Power Plant PSD stations. Also included in Table 3.5.1 are air quality data from the "H" Street SLAM station in Lompoc.

Existing ambient air quality data considered to be representative of actual conditions in the vicinity of the proposed action have been procured as part of efforts to prepare the Authority to Construct application, which will be submitted to SBCAPCD in support of the proposed SLC-7 project.

TABLE 3.5.1

MEASURED AIR QUALITY DATA SUMMARY VAFB AND VICINITY

POLLUTANT	HIGHEST MEASURED CONCENTRATION				CALIFORNIA AMBIENT AIR QUALITY STANDARD	NATIONAL AMBIENT AIR QUALITY STANDARD
	"H" Street - Lompoc[a]	Point Arguello[b]	Jalama Beach[c,d]	STS Power Plant[e]		
Ozone (O_3)						
1-hour average (ppm)	0.11	0.096	0.17	0.103	0.09	0.12
Carbon Monoxide (CO)						
1-hour average (ppm)	6.00	(f)	(f)	1.2	20.0	35.0
8-hour average (ppm)	(g)	(g)	(g)	1.2	9.0	9.0
Nitrogen Dioxide (NO_2)						
1-hour average (ppm)	0.05	0.05	0.047	0.031	0.25	(h)
Sulfur Dioxide (SO_2)						
1 - hour average (ppm)	0.06	(f)	0.012	0.017	0.25	(h)
3 - hour average (ppm)	(g)	(f)	(g)	0.009	(h)	0.5
24 - hour average (ppm)	0.03	(f)	(g)	0.004	0.05	(h)
Suspended Particulate with Aerodynamic Diameter less than 10 Microns (PM_{10})						
24-hour Average ($\mu g/m^3$)	(g)	(g)	(g)	60.4	50.0	150.0
Annual Geometric Mean ($\mu g/m^3$)	(f)	(f)	22	(g)	30.0	50.0

[a] Source: CARB, Summary of 1986 Air Quality Data.

[b] Source: Tracer Technologies 1988.

[c] Source: Dames & Moore 1988.

[d] Period of record is April 1987 through March 1988.

[e] Source: Environmental Monitoring Company, Inc. 1989.

[f] Parameter not measured at this site.

[g] Averaging period not summarized for this site.

[h] No standard.

3.5.1.3 Existing VAFB and Regional Emissions

Regional air quality in the North Santa Barbara County and VAFB area is a direct function of the local meteorology and the mass emission rate of air contaminants emitted from the following source classifications in the area:

- Oil production and processing facilities
- Commercial and municipal sources located in Santa Maria and Lompoc
- Operational sources located at North and South VAFB

A comprehensive air pollutant emissions inventory does not exist for the North Santa Barbara County area. Conversations with representatives of SBCAPCD indicate that such an inventory may be compiled by 1990. Without extensive research into SBCAPCD Authority to Construct (ATC) permit files, it is difficult to assess regional air pollutant emissions contributions related to the first two source categories mentioned above (i.e., oil operations and commercial and municipal sources in Santa Maria and Lompoc). However, air pollutant emissions from normal operations at VAFB are summarized on a regular basis by VAFB personnel. Table 3.5.2 (1986 VAFB Emissions Inventory Summary) describes air pollutant emissions generated by VAFB during 1986. According to the U.S. Department of Transportation (1988), VAFB sources contribute one to two percent to recorded regional emissions.

3.5.2 LOCAL ENVIRONMENT

3.5.2.1 Cypress Ridge

Meteorology

In general, local meteorology in the vicinity of the Cypress Ridge site does not vary significantly with respect to the VAFB region (see Section 3.5.1). On a micro-meteorological scale, it is expected that surface-based northwesterly winds would tend to follow the major topographic features of the Rocky Point/Cypress Ridge area and turn to more of a westerly flow in the vicinity of the Cypress Ridge site. During nighttime hours, stable downslope winds would be expected to drain through the area at relatively low velocity and in a general offshore direction. During Santa Ana conditions, high velocity, easterly winds could be expected through this area.

TABLE 3.5.2

1986 VAFB EMISSIONS INVENTORY SUMMARY

EMISSION SOURCE	TOTAL EMISSIONS (TONS)					
	TSP	SOx	NOx	CO	TOG	OTHER
Adhesive Paint and Solvent Usage						
- Base Supply	----	----	----	----	39.96	
- COCESS	----	----	----	----	35.12	
- CE Contracts	----	----	----	----	6.13	
Household Organic Compounds Usage	----	----	----	----	16.50	
Asphalt Paving	----	----	----	----	4.97	
Asphalt Roofing	----	----	----	----	23.52	
Bulk Fuels Storage Area	----	----	----	----	7.52	
POL Loading Rack	----	----	----	----	1.06	
Generator Emissions						
- Natural Gas	0.00	0.00	0.01	0.24	0.01	
- Diesel	0.23	0.21	3.17	0.69	0.25	
Power Plants	21.33	19.87	298.62	64.95	23.88	
Service Stations	----	----	----	----	32.30	
Aircraft Operations	2.88	3.45	21.79	152.40	58.50	
Aircraft Servicing	0.01	0.01	0.20	6.91	0.23	
Vandenberg Aeroclub	----	----	----	----	0.36	
Pesticides	----	----	----	----	0.41	
Sandblasting	6.56	----	----	----	----	
Building Heating Units (boilers)						
- Propane	0.05	----	1.07	0.22	0.09	
- Natural Gas	1.77	0.21	35.37	7.07	2.83	
- Oil	3.52	125.18	34.62	8.69	1.12	
Family Housing Space Heating	0.84	0.10	16.89	0.46	1.35	
Fire Training Area	2.50	0.00	0.10	3.12	1.05	
Missile Launches (including HCl)	61.35	----	0.67	74.29	----	41.22
Well Water Degasification (H2S)	----	----	----	----	----	7.39
Component Cleaning Facility	----	----	----	----	20.46	
Base Dry Cleaning	----	----	----	----	0.84	
Paint Spray Booths	----	----	----	----	3.38	
Rocket Engine Flushing (SLC-3)	----	----	----	----	15.60	
Incinerators	0.0[illegible]	----	0.01	----	----	
Mobile Sources (Traffic)	----	----	98.63	1225.99	171.05	
Hypergolic Propellant Handling						
- Fuel (Hydrazines)	----	----	----	----	----	1.08
- Oxidizer	----	----	----	----	----	0.44
Wildland Fires (not included in totals)	306.00	----	72.00	2520.00	432.00	
Total 1986 Emissions (tons)	101.06	149.03	511.15	1545.03	468.47	

Source: USAF 1988c.

Air Quality

Local air quality would be expected to be good, due to the lack of emission sources in the area of the proposed site. However, there is potential for localized ambient pollutant concentrations to be in excess of values observed at the Point Arguello monitoring station. This condition could occur due to the cumulative effects of local sources of air pollutant emissions, such as from offshore oil platforms. Further, detailed analysis of this issue will be contained in the ATC application process for SLC-7.

3.5.2.2 SLC-6

Meteorology

In general, local meteorology does not vary significantly with respect to the VAFB region. On a micro-meteorological scale, it would be expected that wind direction at SLC-6 would be from a northern inclination, similar to that seen for Point Arguello in Figure 3.5.1. During nighttime hours, stable downslope winds would be expected to drain through the area at relatively low velocity and in a general offshore direction. During Santa Ana conditions, high velocity northeasterly winds could be expected through this area.

Air Quality

Local air quality would be expected to be good. Air quality data for the SLC-6 site has been measured and is reported in Table 3.5.1. Several emission sources exist at the SLC-6 site but are being used only intermittently and, therefore, do not significantly affect local air quality. Localized ambient pollution concentrations have the potential to be in excess of the recorded levels due to the cumulative effect of offshore oil platforms and the STS power plant during nighttime hours when wind speeds are low. However, these conditions would not be expected to persist, due to higher wind speeds during daytime hours.

3.5.2.3 Boathouse Flats

Localized existing meteorology and ambient air quality in the vicinity of the Boathouse Flats alternative site are expected to be similar to the Cypress Ridge site.

3.5.2.4 Vina Terrace

Localized existing meteorology and ambient air quality in the vicinity of the Vina Terrace alternative site are expected to be similar to the Cypress Ridge site.

3.6 WASTE MANAGEMENT

3.6.1 INTRODUCTION

For this discussion, waste management consists of the treatment and disposal of domestic, industrial, and hazardous wastes generated relative to the proposed SLC-7 project. The existing regional environment includes North VAFB and the surrounding Lompoc Valley. The local environment consists of South VAFB. In the following discussion, wastes will be classified as either: (1) domestic, (2) industrial, or (3) hazardous. Domestic waste is usually found in the form of wastewater or sewage from residential, business, and rural areas. Domestic wastewater principally contains materials which are readily biodegradable and, if properly treated and disposed of, do not present a health or environmental problem. Domestic waste is easily treated by either a septic tank and leach field system where sewage flow rates are low (less than 2,500 gallons per day) or by sewage treatment plants where sewage flow is high.

Industrial waste can be either solid or liquid in form and, unlike domestic waste, may contain small amounts of hazardous substances. Typical producers are businesses and manufacturing plants. Industrial waste differs from hazardous waste in the concentrations of hazardous substances it contains. Characteristics that make a waste hazardous are listed by the EPA in the Code of Federal Regulations (40 CFR 261) and by the California Department of Health Services in the California Code of Regulations (CCR), Title 22, Chapter 30.

For certain classes of industrial waste, treatment and disposal facilities are similar to those for domestic waste. A publicly-owned treatment works (POTW) may obtain a permit from the Regional Water Quality Control Board (RWQCB) to treat some liquid industrial waste. The POTW then may issue individual waste discharge permits with RWQCB approval. For liquid waste that cannot be discharged to a POTW, Class II impoundments can be used for disposal. Class II impoundment specifications are set forth in CCR Title 23, Chapter 3, Subchapter 15, Article 5, Section 2532. Industrial designated and nonhazardous solid wastes must be disposed of in Class II or Class III landfills, whichever applies to the specific waste. Class II and Class III specifications are set forth in the CCR Title 23, Chapter 3, Subchapter 15, Article 5, Sections 2532 and 2533, respectively.

Hazardous wastes are of the most concern environmentally because they are potentially harmful to humans and wildlife, and they can be difficult to treat and/or dispose of compared to domestic and industrial wastes. Hazardous wastes can be either solid or liquid in form. The official federal

definition of a hazardous waste can be found in the Code of Federal Regulations (40 CFR 261 and 40 CFR 401.15). Part 261 lists common characteristics of hazardous wastes, such as ignitability, corrosivity, reactivity, and toxicity. Part 401.15 lists predetermined toxic pollutants. Wastes considered to be hazardous by the EPA have been categorized and grouped by similar characteristics. Each category of similar compounds has been assigned an EPA waste identification number.

California also categorizes and groups wastes, but recognizes more wastes as being hazardous than does the EPA. California wastes are assigned a specific code number. Certain wastes found to be extremely toxic are listed as restricted. These wastes, and their threshold concentrations, are listed in CCR Title 22, Chapter 30, Article 15, Section 66900.

Hazardous wastes, for example, can leach into ground water and result in ground water contamination. Therefore, strict regulations exist for their proper disposal. Hazardous wastes can only be disposed of in a Class I landfill or at an approved treatment facility, the specifications for which are found in CCR Title 23, Chapter 3, Subchapter 15, Article 3, Section 2531.

Certain wastes have been found by the state of California to be extremely toxic and are referred to as restricted wastes. Disposal of restricted wastes is more complicated than disposal of regular hazardous wastes, as they must be pretreated before disposal. Pretreatment usually includes some type of stabilization or solidification to reduce to a minimum the chance of the waste ever leaving the containment area. Another method of pretreatment for restricted wastes is to lower the concentrations of the toxic substances. This is accomplished most efficiently by chemical or biological degradation. Once the levels have been lowered below the restricted waste classification levels, they can be disposed of in a Class I landfill. If disposal is not desired, an approved treatment facility can be used to treat the waste and recycle it.

In response to the 1984 Hazardous and Solid Waste Amendments (HSWA) to the Resource Conservation and Recovery Act (RCRA), the EPA has promulgated regulations concerning the land disposal of hazardous wastes listed in 40 CFR 268.10. These regulations are effective as of August 8, 1988. These regulations set forth treatment standards for so-called "First Third" listed hazardous wastes, specified in 40 CFR 268.10. Treatment standards for the "Second Third" listed hazardous wastes, as specified in 40 CFR 268.11, will be evaluated by June 8, 1989, at which time they will come under the same types of restrictions as the First Third listed wastes. The

remaining hazardous wastes, as specified in 40 CFR 268.12, will be evaluated by May 8, 1990. After May 8, 1990, only hazardous wastes meeting the specified treatment standards will be able to be disposed of in a Class I landfill.

Land disposal of wastes is becoming increasingly expensive due to newer, more stringent regulations governing waste disposal; it may eventually become impossible. Therefore, alternatives should be considered before designating wastes for landfill disposal. One alternative is waste minimization by onsite and offsite recycling, which currently is practiced to reduce the total amount of waste being sent to Class I landfills from VAFB. In 1987, the amount of waste recycled was about 436,640 pounds, or 28 percent of the total hazardous waste generated on VAFB. This waste includes commonly used solvents, oils, paint primer, and batteries. Table 3.6.1 (1987 VAFB Recycled Wastes) shows the types and quantities of these wastes. Recycling helps lead to overall cost reduction in disposal of hazardous wastes.

In case of accidents involving hazardous materials, VAFB has prepared a draft Spill Prevention and Response (SPR) Plan, dated September 1988. This plan is currently under USAF review. The plan will be used to prevent spills of hazardous substances and for cleanup of any spills that might occur. At VAFB, requirements for reporting a spill state that, if a spill involves resources beyond the capability of the Operations Plan (USAF 1981), the on-scene coordinator (OSC) will notify Region IX of the EPA. If the spill occurs offshore, the U.S. Coast Guard is to be notified through the EPA.

3.6.2 REGIONAL ENVIRONMENT

3.6.2.1 Domestic Waste

Regional domestic waste is generated by various residences, businesses, and industrial facilities and is treated at the city of Lompoc POTW, which has a capacity of 5.0 million gallons per day (gpd) and currently operates at 3.5 million gpd. Waste flow from the North VAFB administrative/industrial/ housing area averages 0.8 to 0.9 million gpd, with the balance from the city of Lompoc, Vandenberg Village, Mission Hills, and the fringe areas of these communities served by the Lompoc sanitary sewage system.

TABLE 3.6.1

1987 VAFB RECYCLED WASTES

WASTE	PERCENT RECYCLED	QUANTITY RECYCLED (pounds)	PLACE RECYCLED
1,1,1-Trichloroethane	100	11,820	on- & off-base
Acetone	100	330	on-base
Alcohols, Isopropyl and Methyl	100	30,730	on-base
Freon	100	39,180	off-base
Methyl Ethyl Ketone (MEK)	100	4,210	on- & off-base
Waste Oil	59	258,210	on-base
Sodium Persulfate	100	100	on-base
Trichloroethylene	100	3,340	on-base
Zinc Primer	100	23,690	on-base
Lead Acid Batteries	100	65,030	on-base
TOTAL	--	436,640	--

Source: USAF 1988k.

3.6.2.2 Industrial Waste

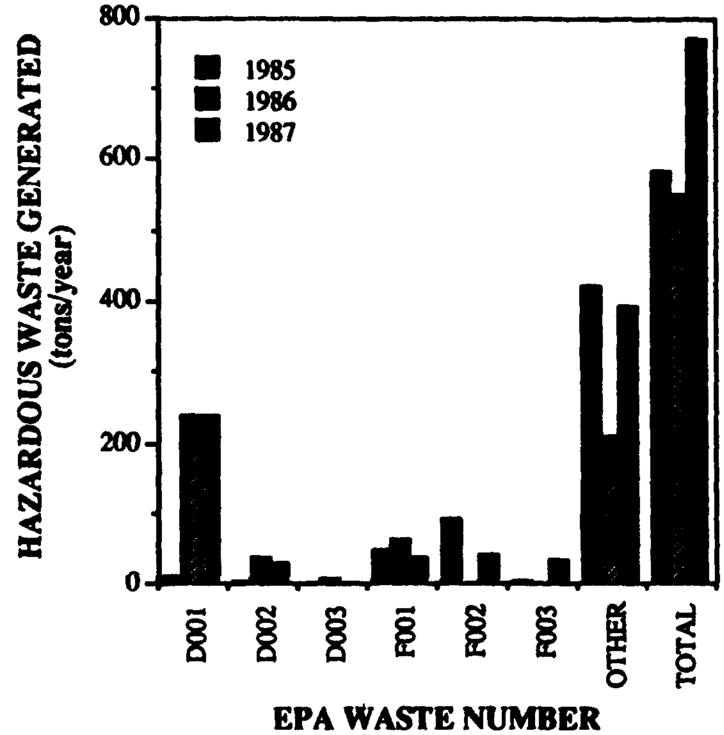
Industrial waste is primarily generated from manufacturing facilities in the city of Lompoc and the North VAFB industrial area. North VAFB launch facilities are additional generators. Liquid industrial waste may be added to the Lompoc sanitary sewage system for treatment by the POTW, provided that a permit from the RWQCB is granted or that no existing permits are violated. A Class II landfill currently exists in the city of Lompoc and accepts various domestic and industrial wastes. A Class III landfill in North VAFB can be used for disposal of some solid industrial waste.

3.6.2.3 Hazardous Waste

On a regional basis, hazardous wastes are generated by industrial and manufacturing facilities on North VAFB and in the city of Lompoc. Additional hazardous wastes are generated by launch facilities on North VAFB. Hazardous wastes generated on North VAFB are transferred for temporary storage (less than 90 days) from their point of origin to a collection-accumulation point (CAP) on North VAFB. A CAP is also located on South VAFB near the SLC-6 wastewater treatment plant. From the CAP, the hazardous waste is transferred to a central EPA RCRA (Part A) permitted hazardous waste storage facility on North VAFB. Once at the storage facility, the waste is separated into groups by EPA hazardous waste number. Each waste is also assigned an appropriate California waste code number.

A summary of the major types and quantities of hazardous wastes stored in the VAFB hazardous waste storage facility is shown in Figure 3.6.1 (VAFB Summary of Hazardous Wastes 1985-1987). Although the waste totals shown in Figure 3.6.1 appear to increase from 1985 to 1987, this increase is actually due to better accounting of hazardous waste at VAFB over the past few years rather than more waste being generated. Wastes generated vary from ignitables, such as waste oils, and corrosives, such as acids and bases, to halogenated and non-halogenated solvents. A more detailed list of the hazardous wastes stored for these three years is shown in Appendix C, Tables C.1, C.2, and C.3. VAFB contracts the disposal of their hazardous wastes to privately owned firms. Once the wastes leave the storage facility, they are either hauled to a Class I landfill or recycled.

HAZARDOUS WASTE DESCRIPTION	EPA WASTE NUMBER	QUANTITY OF WASTE GENERATED (TONS/YEAR)		
		1985	1986	1987
Ignitables (liquid and/or solid)	D001	11.9	238.1	238.6
Corrosives (acid or base liquids and/or solids)	D002	5.5	35.4	29.7
Reactives (solid and/or liquid)	D003	0	6.9	0
Halogenated Solvents (toxic poisons)	F001	47.5	60.9	36.6
Halogenated Solvents (toxic irritating poisons)	F002	92.1	0	40.4
Non-Halogenated Solvents (ignitable poisons)	F003	2.2	0.25	32.1
Contains Misc. EP Toxics, Listed Acute Hazardous Wastes, Listed Toxic Wastes, and California Listed Wastes	Other	422.8	208.1	392.7
TOTAL		581.9	549.7	770.1



Source: USAF 1988k.

FIGURE 3.6.1

VAFB
SUMMARY OF HAZARDOUS WASTES
1985 - 1987

3.6.3 LOCAL ENVIRONMENT

3.6.3.1 South VAFB

Domestic Waste

Domestic waste is generated on South VAFB at sparsely located buildings and space launch complexes (SLCs). Each facility or SLC has its own package sanitary sewage treatment plant, ranging in size from small septic tanks and drain fields (rated at less than 2,500 gpd) to sanitary sewage plants with evaporation/percolation ponds, such as those at SLC-4 (rated at 15,000 gpd).

Industrial Waste

Industrial waste generated on South VAFB is primarily by the SLCs and their ancillary facilities. SLC-3 and SLC-4 are the major industrial waste generators at the present time. A major source of liquid industrial waste generated on South VAFB is launch wastewater. This water is generated before, during, and after a launch and contains metals and acidic compounds. In the past, the wastewater has been discharged directly to grade. Now, because of more stringent regulations, it can no longer be disposed of in this manner (USAF 1988j). At each SLC, the water collects in the individual flame duct wastewater retention basin from which it is transferred to the SLC-6 wastewater treatment evaporation ponds (USAF 1988j). This type of disposal would be used until an alternative method for treating the water is developed.

One option that is presently being considered for treating the wastewater is use of the SLC-6 wastewater treatment plant for removal of contaminants. If this method were adopted, the filtrate, precipitate, and brine taken from the wastewater would be highly concentrated in metals and acidic compounds and would be treated as hazardous waste. The filtrate and precipitate would be collected as a filter cake, placed in a sealed container, and sent to the South VAFB CAP located near the SLC-6 treatment plant. The brine, present as a concentrated liquid, would be sent to the evaporation pond (Class II impoundment capable of holding California designated wastes). After treatment, the waste would be either recycled or sent to an evaporation pond (Class II or Class III impoundment).

Hazardous Waste

Hazardous wastes on South VAFB are generated either by the SLCs or their ancillary facilities. Typical hazardous wastes are hypergolic fuel-contaminated water (high concentrations), various solvents, paints and primers, and photo-developing solutions. These wastes are transported to the South VAFB CAP to be stored until they can be transferred to the central hazardous waste storage facility on North VAFB and then transported off-base for disposal or treatment. Quantities of wastes expected to be generated on South VAFB at SLC-4 are shown in Figure 3.6.2 (Anticipated SLC-4 Hazardous Wastes). The majority of wastes generated at SLC-4 fall into the EPA D001 and D002 categories, or ignitables and corrosives. Ignitables are such things as waste oils, and corrosives are such things as acids and bases. Other wastes include solvents, sealants, paints, and various other compounds considered hazardous by the EPA. Wastes generated at the other SLCs on South VAFB would be similar, but of lesser quantities.

One source of hazardous liquid waste on South VAFB is water contaminated with hypergolic fuels. Water is used to dilute any spill of hypergolic fuel that might occur. After fuel dilution, this water ranges in hypergolic fuel concentrations from 10 ppm to 100,000 ppm. In the past, hypochlorite was used to treat hypergolic fuel-contaminated water in the flame retention basins. Presently, new, more efficient techniques are available and may be adopted. Hydrazine (a hypergolic fuel) was included in the EPA First Third waste category that came under regulation in August 1988. Because of these regulations, hydrazine may no longer be landfilled without pretreatment. Incineration is a commonly used method for disposal of hydrazine-contaminated water, due to the high cost of pretreatment.

3.6.3.2 Cypress Ridge

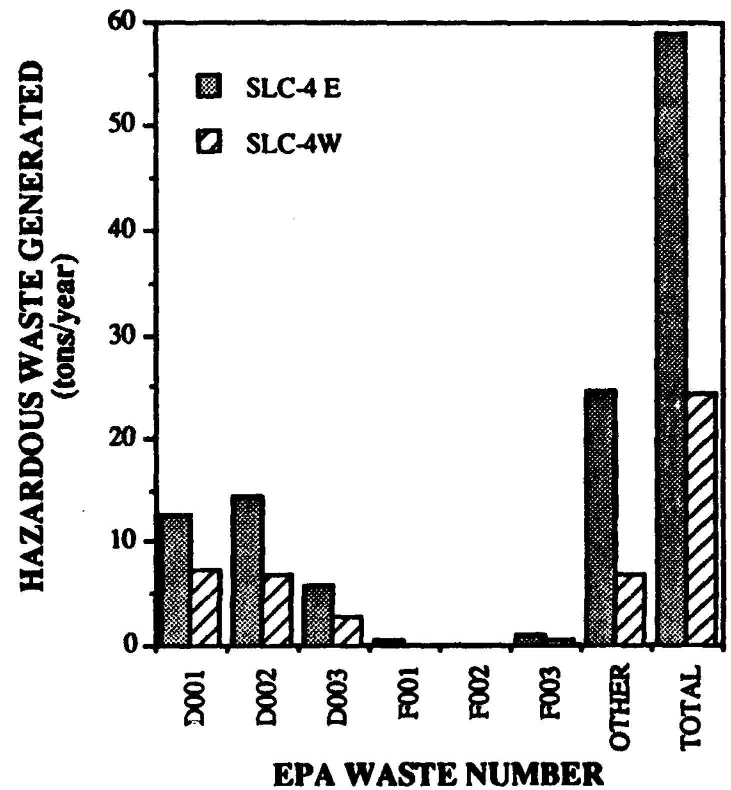
Domestic Waste

There is no activity at the proposed Cypress Ridge site that generates domestic waste.

Industrial Waste

There is no activity at the proposed Cypress Ridge site that generates industrial waste.

HAZARDOUS WASTE DESCRIPTION	EPA WASTE NUMBER	QUANTITY OF WASTE GENERATED (TONS/YEAR)	
		SLC-4 East	SLC-4 West
Ignitables (liquid and/or solid)	D001	12.7	7.4
Corrosives (acid or base liquids and/or solids)	D002	14.5	6.9
Reactives (solid and/or liquid)	D003	5.9	2.8
Halogenated Solvents (toxic poisons)	F001	0.4	0.1
Halogenated Solvents (toxic irritating poisons)	F002	0.01	>0.01
Non-Halogenated Solvents (ignitable poisons)	F003	1.0	0.4
Contains Misc. EP Toxics, Listed Acute Hazardous Wastes, Listed Toxic Wastes, and California Listed Wastes	Other	24.6	6.8
TOTAL		59.1	24.4



Source: USAF 1988k.

FIGURE 3.6.2

ANTICIPATED SLC-4 HAZARDOUS WASTES

Hazardous Waste

There is no activity at the proposed Cypress Ridge site that generates hazardous waste. This site has been included in the VAFB Phase I and II Installation Restoration Program (IRP). According to the IRP, this site does not contain past hazardous waste locations and, therefore, does not come under the jurisdiction of either CERCLA or SARA (USAF 19881).

3.6.3.3 SLC-6

Domestic Waste

SLC-6 utilizes a 35,000 gpd package treatment plant to treat domestic waste generated onsite. This plant discharges effluent into three evaporation/percolation ponds. The plant and ponds are located west and south of the main site. Because only guards and maintenance people are present at the site, the plant and ponds are currently underutilized.

Industrial Waste

No industrial wastes are currently generated at SLC-6, originally designed for onsite treatment of launch water generated during a normal Space Shuttle launch, predicted to be about 1.5 million gallons per launch. A treatment plant located at SLC-6 uses flocculation/ precipitation and reverse osmosis to treat wastewater contaminated primarily with heavy metals and acidic compounds. The facility is not permitted to treat hazardous wastes, so only wastewater classified as industrial waste could be treated there.

Hazardous Waste

No hazardous wastes are currently generated at SLC-6 because the facility has been put into mothball status and is not being used for a specific mission. However, because of prior activity for the Space Shuttle program, the fuel and oxidizer systems are considered to be "hot" or contaminated with residual amounts of hypergolics. These systems were tested to ensure their

integrity and, although the liquid was drained from the systems, all of the vapors could not be removed. The areas included in the testing were the following:

- Fuel Holding Area (N_2H_4, MMH)
    - Ready storage vessel
    - Fill line
    - Return line
- Oxidizer Holding Area (N_2O_4)
    - Ready storage vessel
    - Fill line
    - Return line
    - Waste tank
- Payload Changeout Room
    - Level 12 (MMH, N_2O_4)
    - Level 107 (MMH, N_2O_4)
    - Level 155 (N_2H_4)
- Mobile Service Tower (N_2H_4)
    - -3 Panel
    - -4 Panel

Hypergolic fuel-contaminated systems have been purged using nitrogen gas. In order to completely decontaminate the lines, the systems would have to be flushed with an estimated 82,000 gallons of liquid chemical. The liquid chemical would be treated as a hazardous waste and disposed of at an appropriate treatment facility. The remaining concentrations of N_2O_4, N_2H_4, and MMH in the system would range from about 1 ppm to about 2,000 ppm.

This site has been included in the VAFB Phase I and II Installation Restoration Program (IRP). According to the IRP, this site does not contain any hazardous waste locations and, therefore, does not come under the jurisdiction of either CERCLA or SARA (USAF 19881). The contaminated hypergolic lines would not come under the jurisdiction of CERCLA or SARA because they would be considered part of a process and not a waste site.

3.6.3.4 <u>Boathouse Flats</u>

<u>Domestic Waste</u>

There is no activity at the Boathouse Flats site that generates domestic waste.

Industrial Waste

There is no activity at the Boathouse Flats site that generates industrial waste.

Hazardous Waste

There is no activity at the Boathouse Flats site that generates hazardous waste. This site has been included in the VAFB Phase I and II Installation Restoration Program (IRP). According to the IRP, this site does not contain any hazardous waste locations and, therefore, does not come under the jurisdiction of either CERCLA or SARA (USAF 19881).

3.6.3.5 Vina Terrace

Domestic Waste

There is no activity at the Vina Terrace site that generates domestic waste.

Industrial Waste

There is no activity at the Vina Terrace site that generates industrial waste.

Hazardous Waste

There is no activity at the Vina Terrace site that generates hazardous waste. This site has been included in the VAFB Phase I and II Installation Restoration Program (IRP). According to the IRP, this site does not contain any hazardous waste locations and, therefore, does not come under the jurisdiction of either CERCLA or SARA (USAF 19881).

3.7 NOISE

Noise is often described as unpleasant sound. Humans respond to sound based on its magnitude as a function of frequency and time, but do not respond to all frequencies of sound the same way. To accommodate this, a method of weighting sound levels over the human hearing range has been developed. This method uses an electrical weighting network as a way of simulating the human ear's response to sound. Each frequency of sound contributes proportionally to create a total perceived sound level. When incorporated with a sound level meter, the total sound level is represented as an A-weighted Sound Level in decibels (dBA) (US EPA 1974).

Noise at any given location is usually not steady and tends to fluctuate considerably with time. To accommodate for this characteristic, various methods have been developed to calculate a cumulative noise exposure level. These methods use the varying levels of noise present over a period of time to calculate the cumulative effect of the noise exposure on the environment (US EPA 1974). The EPA has selected the Equivalent Sound Level (L_{eq}) as a means of identifying levels of environmental noise. The L_{eq} is calculated as an equivalent "steady" noise level over a period of time. The L_{eq} contains the same amount of energy as would the actual noise levels over the same period of time.

Another method of relating varying noise levels to an equivalent level is the Community Noise Equivalent Level (CNEL). This method uses weighting factors to place greater significance on noise events which occur during evening and night periods. The sound levels are calculated for a 24-hour period and weighted 5 dBA for evening hours and 10 dBA for nighttime hours. For example, a noise that creates a sound level of 60 dBA during the daytime would be reported as 65 dBA during evening hours and 70 dBA during nighttime hours. The CNEL has been adopted by California for monitoring noise around airports (US EPA 1974).

The CNEL does not always give a good representation of high noise levels that might occur during the day because the 24-hour averaging tends to under-emphasize noise level peaks. For a single noise of high magnitude (i.e., space vehicle launch, plane overflight), the Single Event Noise Exposure Level (SENEL) is often more representative than the CNEL. The SENEL uses the duration and magnitude of the maximum sound level (L_{max}) to give a more accurate indication of the peak level of noise exposure during a given time period (US EPA 1974).

Noises may come from either a "line source" or a "point source." Highway traffic noise on high volume roadways simulates a line source. The decrease in sound over distance is a nominal 3.0 dBA drop with each doubling of distance between the noise source and the noise receiver. The actual rate, however, can approach 4.5 dBA because of attenuation caused by grass, shrubbery, trees, etc. (City of Lompoc 1988a).

Noises generated by stationary objects simulate a point source. In a relatively flat environment free of barriers, noise spreads from the source in a spherical manner. The decrease in sound over distance is about 6.0 dBA for each doubling of distance or 20 dBA for each distance factor of 10. Under certain conditions, sound attenuation from a line source starts to resemble that of a point source. For example, a train resembles a line source near the railroad tracks and a point source at distances beyond three-tenths of the train length (City of Lompoc 1988a).

3.7.1 REGIONAL ENVIRONMENT

The region surrounding VAFB is mainly undeveloped and rural, as discussed in Section 3.13, Land Use, with some unincorporated residential areas within the Lompoc and Santa Maria Valleys. The two urban areas in the region are the cities of Lompoc and Santa Maria, which support a few localized industrial areas. Sound levels measured for most of the region are normally low, with higher levels appearing in industrial areas and along transportation corridors. Rural areas in the Lompoc and Santa Maria Valleys would be expected to have low overall CNEL levels, normally about 40 to 45 dBA. Infrequent aircraft flyovers and missile launches from VAFB would be expected to increase noise levels for short periods of time (City of Lompoc 1988a).

Urban areas are primarily affected by noise from automobiles, trucks, trains, and aircraft. CNEL contours have been measured based on typical sound levels in the Lompoc area. These contours show the highest CNEL levels (greater than 65 dBA) appearing around the Southern Pacific Railroad and major roadways, with lower CNEL levels (50 to 65 dBA) further removed from main transportation corridors. Sound levels in Santa Maria would be expected to be similar to those in Lompoc (USAF 1978). Areas of higher localized noise levels would occur around stationary industrial sources. Presently, few of these stationary sources exist in the Lompoc and Santa Maria areas, thus keeping overall sound level contours relatively low (City of Lompoc 1988a).

An additional source of noise in the area is the VAFB airfield. This airfield follows state regulations concerning noise and maintains a CNEL equivalent to 65 dBA or less. Two types of operations take place at this airfield: (1) regular takeoffs and landings, and (2) touch-and-go

takeoffs and landings. Touch-and-go maneuvers are used for training purposes and create noise levels similar to regular aircraft takeoffs and landings. About 7,600 combination touch-and-go and regular landings occur per year at VAFB. Aircraft using the facility vary from transport and bomber aircraft to fighter jets. Cargo planes average about 2,300 operations per year and vary on a daily basis (USAF 1988c). CNEL levels at the VAFB airfield are regulated and cannot be in excess of 65 dBA at the airfield boundary (USAF 1988b).

Other, less frequent but more intense sources of noise in the region are missile launches from VAFB. Current launches include Scout, Atlas, and Minuteman missiles. Minuteman missiles are launched from North VAFB, while Scout and Atlas missiles are launched from South VAFB. Future launches from South VAFB will include the Titan II and Titan IV from SLC-4 West and East, respectively. There may be future Space Shuttle launches from SLC-6, but none are planned in the foreseeable future.

Noise levels in Lompoc and Santa Maria from Minutemen missile launches would be expected to be a maximum of 49 dBA and 74 dBA, respectively (USAF 1987c). Titan II and Titan IV launches from SLC-4 have been predicted to produce noise levels of about 88 to 92 dBA and 100 to 104 dBA, respectively, in the Lompoc vicinity. Noise levels in Santa Maria created by launches from SLC-4 have been estimated at between 79 and 82 dBA for the Titan II and 91 to 94 dBA for the Titan IV (USAF 1987c and 1988b). In the Lompoc area, noise levels resulting from the launch of the Space Shuttle from SLC-6 would be about 110 dBA and in the Santa Maria area about 98 dBA (USAF 1978). Because launches from all of these facilities would occur intermittently, the resulting noise would not cause an increase in the L_{eq} or CNEL levels in nearby areas.

3.7.2 LOCAL ENVIRONMENT

As discussed in Section 3.13 (Land Use), North VAFB contains most of the base facilities, and South VAFB is largely undeveloped, with some scattered facilities. The proposed SLC-7 and alternative sites are located near the southern end of the paved Coast Road. Most of the area south of SLC-6 is undeveloped and used for cattle grazing.

Noise levels measured on North VAFB are generally typical of urban areas with little industrialization. South VAFB noise levels would be expected to be similar to levels found in a rural area, as there is little noise from SLC-6, and minimal development in the rest of the area (USAF 1978).

3.7.2.1 Cypress Ridge

Noise levels at the Cypress Ridge site would be expected to be similar to those observed in other undeveloped rural areas, averaging about 40 to 45 dBA (US EPA 1974). Noise levels may occasionally rise due to trains passing on the nearby railroad, aircraft flyover, or the infrequent event of a missile launch.

3.7.2.2 SLC-6

Noise levels at the SLC-6 site would be similar to those in an urbanized, industrial area, averaging about 50 to 60 dBA due to ongoing maintenance activities. Nighttime noise levels would be less, due to limited activity and would be similar to those expected to be found in the Cypress Ridge area, about 40 to 45 dBA. Noise levels would be expected to increase due to trains passing on the nearby railroad, aircraft flyover, or the infrequent event of a missile launch from another SLC.

3.7.2.3 Boathouse Flats

Background noise levels at the Boathouse Flats site would be similar to those found at Cypress Ridge. Some increase may be expected, dependent on surf action.

3.7.2.4 Vina Terrace

Background noise levels at the Vina Terrace site would be similar to those found at Cypress Ridge.

3.8 VISUAL RESOURCES

3.8.1 REGIONAL ENVIRONMENT

The visual environment in the vicinity of South VAFB is varied and characterized by rolling hills covered with Chaparral and oak trees, valleys utilized for grazing or more intensive agriculture, and urbanization of the Lompoc Valley. Topography is largely dominated by the east-west trending Santa Ynez Mountains, which narrow toward the coast and terminate at Point Arguello. The adjacent Lompoc Valley is occupied by commercial and residential development in the city of Lompoc and by surrounding agricultural and scattered residential areas. The Lompoc Valley is drained toward the west by the Santa Ynez River, which provides a natural boundary generally separating North VAFB from South VAFB. Views of the coastline are generally not available from inland locations due to access limitations and intervening topography.

South VAFB itself is characterized by the somewhat rugged terrain of the western Santa Ynez Mountains, which rise to more than 2,000 feet at Tranquillion Peak. From this elevation, the mountains drop toward the coast, terminating at a narrow marine terrace at an elevation of about 50 to *100 feet above the ocean. Slopes and terraces* are covered with grasses and chaparral or coastal sage vegetation. With the exception of scattered launch facilities, South VAFB is generally undeveloped. The most visually significant aspects of the natural South VAFB environment are the rugged coastline and adjacent mountain slopes. The most significant man-made features are the space launch complexes.

From the east, views of South VAFB and the approximately 40 miles of coastline are generally restricted by distance from public/private land, limited roadways, and the topography of the Santa Ynez Mountains, which extend to Point Arguello at Cypress Ridge. Views along the coastline are separated to areas north or south of this point. Since public access to South VAFB and the project area is generally not permitted, viewpoints are primarily limited to: (1) those from marine traffic, (2) views from passengers on the Southern Pacific Railroad, which traverses the area parallel to the coastline, and (3) views from the nearest public access points - Ocean Beach County Park and Jalama Beach County Park.

The marine traffic offshore of South VAFB is primarily for fishing and occasional pleasure boating. The number of public views from the ocean is limited. Railroad traffic through VAFB provides the closest views of the area. About six trains per day pass through the area. From the west, views from marine and railroad traffic include the existing South VAFB launch complexes, including SLC-3, SLC-4, and SLC-6.

Views of the South VAFB coastline north of Point Arguello are available from Ocean Beach County Park. About 32,000 people visit this park annually (Hobbs, pers. comm. 1988). Views from this location include the existing SLC-3 and SLC-4 facilities. Neither the existing SLC-6 nor the proposed SLC-7 or alternative sites are visible from this park.

Perhaps the most frequent views of the South VAFB coastline are from Jalama Beach County Park, which borders the southern limit of South VAFB and offers views north to Point Arguello. The Santa Barbara County Parks Department estimates that between 255,000 and 315,000 people visit this park annually. The proposed Cypress Ridge project area and the Boathouse and Vina Terrace alternatives can be seen from Jalama Beach at times during the year when the weather permits distant views. Views from this area are expansive and reflect the predominantly undeveloped nature of the coastline. Existing facilities such as SLC-3, SLC-4, and SLC-6 cannot be seen from this location due to intervening topography of the Santa Ynez Mountains.

3.8.2 LOCAL ENVIRONMENT

3.8.2.1 Cypress Ridge

The Cypress Ridge site lies on the lower limits of Cypress Ridge, which slopes toward the south onto an elevated marine terrace at an elevation between 250 and 450 feet. The site is covered with grasses and coastal sage scrub vegetation and is relatively undisturbed. Some areas have been cleared to form a fire break, and a road cut for the Space Shuttle External Tank Tow Route (Coast Road) passes through the site. Power lines, telephone lines, and fencing extend along the western portion of the site, parallel to Coast Road.

Local public views of the site are limited to occasional marine traffic and daily railroad traffic. Observations from marine traffic are undocumented, but they are expected to be infrequent, somewhat distant, and limited to fishing, offshore oil development traffic, and occasional pleasure boating. Railroad traffic permits regional as well as local views of the site, as the trains pass within 400 feet of the site boundary.

3.8.2.2 SLC-6

The SLC-6 site lies on an elevated marine terrace at an elevation of approximately 300 to 500 feet. The site is developed and contains several large structures that can be seen by occasional marine traffic and daily railroad traffic. The visible structures include the Mobile Service Tower, Solid Rocket Booster Receiving, Refurbishment, and Subassembly Facility, Payload Processing Room, Shuttle Assembly Building, and Access Tower.

Local and distant public views from occasional marine traffic and daily railroad traffic are similar to those for the Cypress Ridge Site.

3.8.2.3 Boathouse Flats

The Boathouse Flats site lies adjacent to the coastal marine terrace at an elevation of about 100 feet. The site is relatively flat and is covered predominantly by annual grasses. It is bisected by the Space Shuttle External Tank Tow Route, which crosses in a northwest/southeast direction. Adjacent development includes structures associated with the former U. S. Coast Guard Rescue Station.

Local public views from occasional marine traffic and daily railroad traffic are similar to those for the Cypress Ridge site.

3.8.2.4 Vina Terrace

The Vina Terrace site is located on a ridge at elevations ranging from 610 to 840 feet. It is covered with coastal sage scrub vegetation, chaparral, and annual grasses. The site is relatively undisturbed and has no roads or structures.

Local public views of this site are limited due to its remote ridge-top location. Distant views are available from marine traffic and daily railroad traffic.

3.9 CULTURAL RESOURCES

Cultural resources are places or objects that are important for scientific, historic, and/or religious reasons to cultures, communities, groups, or individuals. Cultural resources include historic and prehistoric archaeological sites, architectural remains, structures, and other artifacts that provide evidence of past human activity. Cultural resources also include places of importance in the traditions of societies or religions.

Section 106 of the National Historic Preservation Act (NHPA) establishes compliance procedures that require federal agencies to take into account the effect of their undertaking on properties included in or eligible for inclusion in the National Register of Historic Places (National Register). Once sites of archaeological or historic value are determined to be eligible for listing in the National Register, they are subject to a Determination of Effect under Section 106 and development of a Treatment Plan when the effect could be adverse. For the proposed SLC-7 project, this applies to the historic former U.S. Coast Guard Rescue Station structures, as they have been determined eligible for inclusion in the National Register. It also applies to archaeological sites within the proposed construction area that are or may be eligible for inclusion in the National Register. These are the primary planning procedures involved in preserving historic and prehistoric sites and will govern the analysis and preservation of historic values present at sites within the study area.

For the proposed Cypress Ridge and alternative SLC-6, Boathouse Flats, and Vina Terrace sites and utility corridors, the pertinent criteria for determining eligibility of an archaeological site involve the potential of the site to contribute to knowledge concerning prehistory of the area. Archaeological sites within the areas of potential effect contain artifacts and/or other resources that provide information as to the types of prehistoric activities conducted there, the numbers of people, and the dates of site occupation. This type of information may be significant in gaining an understanding of past ways of life. Eligibility is determined according to the presence of a variety of factors which include site size, organization, uniqueness, and number and type of remains.

The following sections describe the cultural baseline information as it is currently understood for the proposed and alternative SLC-7 sites. The information is a summary of data collected from previously prepared archaeological documents pertinent to VAFB as a whole and, more specifically, to South VAFB. Existing data were augmented by an intensive surface inventory of a study area encompassing the proposed Cypress Ridge site, the alternative Boathouse Flats and Vina Terrace sites, the alternative SLC-6 site to the fence line, and the proposed utility corridors, as

shown in Figure 3.3.2. The area inside the security fence at SLC-6 was not included, since archaeological resources that may have been present would have been removed or covered during construction of existing facilities.

The 1988 surface inventory was conducted by qualified archaeologists and Native American Advisors. Complete details of the literature search and inventory have been submitted concurrently with this Draft EIS to the California State Historic Preservation Officer (SHPO), Advisory Council, and Santa Ynez Reservation. This information is the basis for informal Section 106 consultation with the SHPO and Santa Ynez Reservation.

3.9.1 REGIONAL ENVIRONMENT

3.9.1.1 Historic Properties

Within the region of the proposed SLC-7 project are certain historic properties which are recognized, documented, and being administered for the benefit of the public. These include:

- La Purisima, the eleventh Spanish mission in the state of California and the fourth in Chumash territory. The original buildings were destroyed in the 1812 earthquake, and the mission was rebuilt at its present site northeast of Lompoc. The mission has been restored and is administered as a State Historic Park. The site is listed in the National Register of Historic Places (NRHP) and is California Historical Landmark No. 340.

- Point Conception Lighthouse, first constructed in 1855. Listed in the Santa Barbara County Historic Inventory.

- The McKay-Spanne House, designated a local landmark by Native Daughters of the Golden West.

- Other historic structures present in the City of Lompoc.

- An historic marker, a large iron anchor, has been established at Point Pedernales in memory of a multi-ship wreck on September 8, 1923. On that day, while navigating in a fog bank, 7 of 14 destroyers in a U.S. Navy flotilla beached on the rocks. Twenty-three men were killed. The hulls of the ships can be seen from the Point.

- Point Arguello U.S. Coast Guard Rescue Station, which consists of an administration/barracks building and a garage. The buildings are wood frame structures covered with wood shingles. The facility was constructed in 1936 and deactivated in 1952.

3.9.1.2 Prehistoric Resources

Documentation of the archaeological record is important within the VAFB region in general and the proposed SLC-7 study area in particular. It is known that the region that comprises both VAFB and the proposed project site was an important settlement area during prehistoric and protohistoric time. Archaeological investigations to date have unearthed evidence of prehistoric and protohistoric societies that can be linked to contemporary Native American Chumash groups who currently live in the area. The prehistoric societies occupying the VAFB area evolved in the region of Santa Barbara County during at least the last 9,000 years.

Prior to the Spanish incursion into California, the Chumash were the human inhabitants of most of San Luis Obispo County, all of Santa Barbara County, most of Ventura County, westernmost Los Angeles County, and part of Kern County. The descendants of the native people continue to reside in the area of VAFB and maintain their identity as Chumash. The Santa Barbara Channel Chumash lived on both the islands and the mainland coast, including what is now VAFB, as part of the Lulapin confederation whose northern boundary was Casmalia Ridge (King 1984). Some of the Chumash lived in a village known as Nocto, on South VAFB within the vicinity of the proposed SLC-7 project. Chumash from this village were baptized during the historic period of missionization, concurrent with the Spanish Conquest of California, which began in 1769.

The Spanish responsible for settlement in California considered the Chumash to be the most advanced native society of Spanish California and observed that they differed from surrounding nationalities in their emphasis on manufacturing and trade, facilitated by a complex bead money system. The Spanish admired the Chumash for their skill as craftsmen and traders, their work ethic, and their development of maritime fishing. The Spanish noted that the Central Chumash population was greater than the populations of other areas of California and, because of the large number of men who could be organized for warfare, feared them more than any other California group encountered during the establishment of Spanish rule (King 1976). Protohistoric Chumash society was a complex non-agricultural society. Villages in the VAFB area were abandoned in 1803 when surviving residents were recruited into Spanish missions. The southern part of VAFB was subsequently used for livestock grazing.

The evolution of Chumash society is reflected in changes in artifact forms and diversity, changes in plant and animal food refuse, changes in the organization of cemeteries, and shifts in settlement patterns (King 1982). The study of this evolution is relevant to the development of anthropological theory concerning the evolution of complex societies. Archaeologists studying the

development of Chumash society interpret changes that have been observed from differences in artifacts, features, and plant and animal remains. In human social systems, changes in resource use can be interpreted as being the result of social changes that allow for effective storage of resources, coordination of activity, or market opportunities. Changes in resource use can also be the result of changes in climatic conditions which, in turn, result in changes in the relative frequencies of resources that are available. The resolution of different interpretations requires the systematic study of changes that are documented in the archaeological record.

Archaeological research in California has resulted in the recognition of regularities in changes of artifacts used in most areas of the state. Analysis of collections from areas historically occupied by the Chumash has resulted in relatively detailed knowledge of changes in many artifacts. However, knowledge of the sequences and distributions of settlement patterns, house types, and food remains is still comparatively limited.

The "Proposed Archaeological Element of the Santa Barbara County Cultural Resources Management Plan" presents a discussion of archaeological research goals in the Santa Barbara Channel region. It states that the importance of archaeological resources to prehistory should be viewed in terms of their relevance to addressing research problems and indicates the value of Santa Barbara County archaeological resources for resolving such problems. One of the categories discussed in the plan is the study of settlement patterns, which requires knowledge of the distributions of sites during different time periods and knowledge of the range and frequency of different activities conducted within these sites.

The perception that the prehistory of the VAFB area can best be understood by knowing the reasons behind the formation of all sites in the region has guided research in the area since the first base-wide survey in 1969. A related theme of much recent research has been the explanation of the rationale for the location of prehistoric sites and the artifacts contained within them. The explanation for the observed distribution of sites requires an understanding of social organization as it relates to population size, dispersal, or aggregation and resource acquisition and concentration.

Prehistoric archaeological sites in Santa Barbara County are important because they contain the unique record of the development of Chumash society. Preservation of this record is important to the living Chumash out of respect for ancestors and ancestral lands and resources and the importance of this for perpetuating Chumash society.

The recent work at the SLC-7 study area incorporates these considerations. The importance of the study area relates to its ability to contribute knowledge about the general patterns of prehistory and, specifically, about the patterns of life of the inhabitants of the nearby village of Nocto and earlier prehistoric settlements in the area.

3.9.1.3 Paleontology

VAFB

Paleontological resources include examples of ancient organic life preserved as fossils. Fossils found in the vicinity of VAFB include remains of both vertebrate and invertebrate animals. The lithologic units in the region have been studied by Gray (1985) and rated for paleontological potential (see Table 3.9.1, Paleontological Potential of Rock Units). The unit with the greatest potential is the terrestrial upper Pleistocene terrace deposit found on old wave-cut platforms. Remnants of these terraces are found on South VAFB, especially the low marine terrace known as Sudden Flats, which extends west to the Boathouse Flats alternative site.

The Orcutt Sands of the middle Pleistocene have a low potential for fossil discovery, while the Miocene Monterey Formation has moderate potential. Monterey rocks can also yield vertebrate fossils such as fish, fish scales, insects, and crabs. Later Miocene deposits can contain numerous assemblages, including bony fish, shark, birds, and mammals. There is a history of fossils from the above-mentioned formations of VAFB. The continental terrace deposits near Point Sal yielded partial remains of mammoth, ground sloth, horse, and camel (approximately 45,000 years old) (Gray 1985). The Monterey Formation has yielded imprints of algae, fish fragments, and coprolite materials on North VAFB (Parsons 1982). Other locations on North VAFB yielded whale bones and fish fragments (Parsons 1981).

The upper and middle Pleistocene formations also have yielded fossil remains on South VAFB. On the Sudden Flats, which extends south of the project area, a deposit yielded mammoth and horse fossils approximately 45,000 years old. Also, locations near SLC-6 have yielded fish and crab remains (Parsons 1980) and whale bone (Parsons 1983).

TABLE 3.9.1

PALEONTOLOGICAL POTENTIAL OF ROCK UNITS

GEOLOGIC AGE	FORMATION	ROCK DESCRIPTION	VERTEBRATE FOSSIIL MATERIAL	POTENTIAL FOR VERTEBRATE FOSSILS
Holocene	Alluvium/ Colluvium	Unconsolidated, uncemented gravel, sand, silt, and rock.	Archaeological remains	Low; vertebrate fossils considered in rock units older than Holocene.
Upper Pleistocene	Terrace Deposits	Qt_1 (marine); semi-consolidated, clean to clayey, well sorted sands on beveled rock surface of wave-cut platform (marine terrace deposits - 120,000 to 85,000 years).	Some bone material of marine origin	Low; most deposits contain invertebrate marine fossils.
		Qt_2 *(continental)*; semi-consolidated, silty to clayey sands, clayey silts, gravels in silty sand matrix on a wave-cut platform and its mantle of marine terrace deposits (85,000 to 45,000 years); non-marine.	Mastadon, mammoth, camel, horse, ground sloth, micro-vertebrae	Moderate to high.
Middle Pleistocene	Orcutt Sand	Semi-consolidated sands and clayey sands, inclined terrace deposits; non-marine.	None; questionable bone chips	Low; ancient dune sand.
Upper Miocene	Monterey Formation	Consolidated; diatomaceous mudstone, porcelaneous shales, chert lenses, siltstone; marine.	Numerous fish fossils; whale, porpoise	Moderate; marine mammal bones; considerable fish material, whole fish fossils located along bedding planes widespread in Southern California.

Source: Modified from Gray 1985.

Channel Islands

An important scientific and aesthetic resource of San Miguel Island consists of the caliche plant fossils known as rhizoconcretions. They range in size from pencil-sized or smaller in diameter and a few centimeters high to specimens 0.75 m in diameter and 2.5 m high. Some are hollow; others are solid, and some of the small ones are extremely fragile. Whether they are solid or hollow seems not to be a factor in ease of breakage. They break naturally under the impact of strong winds, animals, and blowing sand that erodes their base. New caliche fossils are constantly being exposed as the covering dunes are stripped away, while the older ones are abraded and weathered by wind and rain. This is an inevitable and ongoing natural process.

3.9.2 LOCAL ENVIRONMENT

3.9.2.1 Historic Properties

The project area was part of the lands of La Purisima Mission until granted to Anastasio Carrillo in 1837 as part of the Punta de La Concepcion land grant and is entirely within the part of the land grant that was purchased by Robert Sudden in 1882. The area remained part of the Sudden Ranch until 1966, when the ranch was purchased by the USAF. A number of ranch buildings had been constructed and occupied in the area after 1880 (Kahn 1981), but none remain.

North and west of the project area is the former Coast Guard Station and light tower at Point Arguello, first established in 1901, although the original structures are no lor ger standing. The current navigational facilities were built after 1950.

Immediately west of the project study area is the former U.S. Coast Guard Lifeboat Rescue Station and Lookout Tower, constructed in 1936 and deactivated in 1952. The facility, known as the Boathouse, now consists of an administration/barracks building and a garage. The station is of architectural interest as one of the few West Coast representations of U.S. Colonial revival style. The buildings are wood-framed structures covered with wood shingles, as was typical of East Coast construction at the time. The facility has been declared eligible for inclusion in the National Register on the basis of its contribution to understanding California architecture, the 1920s Colonial revival, and the unique use of rails for launching and retrieving life boats. The boathouse/pier complex was removed during construction of the Space Shuttle facilities after completion of Section 106 consultation with the SHPO and Advisory Council and the signing of a

Memorandum of Agreement that outlined required mitigation. Mitigation included archival documentation, restoration of the administration/barracks building and garage, and advertising the hardware from the facility so that its availability for curation would be known to marine museums.

3.9.2.2 Prehistoric Resources

An intensive cultural resources inventory and literature search were conducted from February through May 1988 to provide baseline cultural resource background for the proposed Cypress Ridge and alternative SLC-6, Boathouse Flats, and Vina Terrace sites, including their respective utility corridors. As previously mentioned, that portion of the SLC-6 site inside the security fence was not included in the surface inventory, since archaeological resources that may have been present would have been removed or covered due to previous construction. The area studied, as shown in Figure 3.3.2, encompasses nearly 1,300 acres, generally bounded by Point Pedernales, the Southern Pacific Railroad, a point south of Rocky Point, and a generally north-south line approximately one-quarter to one mile inland.

Most of the archaeological sites discussed below have been identified and recorded over the past approximately 25 years. These include sites found by independent archaeologists interested in the area before it became part of VAFB, as well as sites discovered during investigations of other USAF projects, primarily for the Space Shuttle at SLC-6. They are discussed here because of their proximity to components of the proposed SLC-7 project and, therefore, their potential to be impacted by the proposed action. Summarized descriptions of the sites are identified by prefix: (1) SBa- for sites previously submitted to the State Clearinghouse at the University of California at Santa Barbara (UCSB) and (2) E- for sites recorded during the 1988 cultural resources inventory for which site records are now being processed for submittal to the State Clearinghouse.

3.9.2.3 Cypress Ridge

The study area for the proposed action includes a portion of the area that also was inventoried for the Space Shuttle at SLC-6, extending from the base of Cypress Ridge, north to SLC-6, and south and west to the Southern Pacific Railroad tracks. This is a sensitive area within which buried site deposits were consistently found during excavations for SLC-6. Buried archaeological site areas have consistently been found between the recorded sites and in a large area around their original boundaries, indicating the presence of larger sites.

In addition, there is another previously discovered site, a Chumash rock art site (SBa-550), located on a ridge above the proposed project area. The site contains a panel with red paintings of sun or universe symbols and lineal elements.

SBa-1686

Controlled archaeological excavations were previously conducted at SBa-1686 to collect information from sites that were in areas for construction of the Space Shuttle External Tank Processing and Storage Facility. The excavations and surface investigation yielded projectile point fragments, flake tools, one drill, stone knife blank fragments, and more than 6,000 waste flakes.

Three sites were identified during monitoring of grading activities in the vicinity of N Road immediately south of SLC-6. Because these three sites were identified in all of the deeply graded areas, they could be part of one large site. At SBa-2219, buried stone artifacts, including biface and triface manos, hammerstones, chopper, and a possible anvil were found near the intersection of N Road and the new Coast Road. At SBa-2218, biface and triface manos and hammerstones were found, associated with construction of Hazardous Waste Ponds A and B. At SBa-2217, near the road east of the ponds, three manos were found.

SBa-1149

SBa-1149 was first recorded in 1974 as an historic ranch site with a cypress tree windbreak. On the surface, porcelain fragments, pink glass, iron fragments, red brick, and abalone shell were observed. The site was dated as more recent than 1860. In 1982, during a re-examination as part of the Space Shuttle External Tank Tow Route, prehistoric cultural materials were identified in the vicinity of historic site SBa-1149H. A subsurface testing program yielded Monterey chert flakes and 10 grams of *Mytilus Californianus* shell. No glass, metal, or other historic materials were discovered. Based on this information, the prehistoric component of SBa-1149 was estimated to extend along Coast Road for approximately 100 to 150 meters.

Archaeological monitoring of the site during construction of the Space Shuttle External Tank Tow Route resulted in the recovery of approximately 170 artifacts and one feature/cache of preforms and bifaces. Artifacts included biface and triface manos, preform and biface fragments, cobble flaking hammers, angular hammers, scrapers, projectile points, fragments, and debitage. The occurrence of trifacial forms of manos indicates that occupation at SBa-1149P occurred primarily during the Early Period. The artifact distribution may indicate the presence of small household sites occupied 3,000 to 8,000 years before present (B.P.).

During the 1988 SLC-7 inventory conducted by Environmental Solutions, Inc. and inventories conducted previously by Weaver (1987) and Marmor (1988), a number of surface cultural materials were found both north and south of the Coast Road/External Tank Tow Route in the vicinity of Cypress Ridge. Six artifact concentrations and one shell concentration have been identified, and numerous isolated artifacts were found between these concentrations (Environmental Solutions 1989d). In most areas where artifacts have been found during subsurface monitoring, the artifacts were not visible on the surface prior to grading. The boundaries of SBa-1149 have been enlarged, based on results of 1988 subsurface inventories and shovel test pits.

SBa-1114

SBa-1114 is located a short distance south of SBa-1686 and is adjacent to the northern end of the point where artifacts were found at SBa-1149P during construction of the External Tank Tow Route. The site was described as having a low density of chipping waste. Several isolated flakes were found between this site and SBa-1686 during the 1988 surface inventory. It appears that sites SBa-1114, SBa-1149P, and SBa-1686 may all be part of one very large site or site complex.

SBa-1117

SBa-1117, first recorded in 1974, occupies a large portion of the Cypress Ridge site, originally estimated to measure approximately 75 meters by 50 meters and located on both the north and south sides of the Coast Road. The site was identified on the basis of the presence of a trace to light density of shell and chert chipping waste (Glassow et al. 1976).

In 1983, during construction activities related to the External Tank Tow Route, a buried cultural deposit was identified at SBa-1117, south of Coast Road. It was suggested that the buried southern part of SBa-1117 may be connected to SBa-1547, which includes at least two shell middens, and, in the southern portion, at least half a dozen flake and artifact concentrations. It was also noted that this site may be contemporaneous with SBa-637 (Craig and Glassow 1978). SBa-1117 and three other sites (SBa-712, SBa-1544, and SBa-1547) are part of the Oil Well Canyon site cluster and have been determined eligible for inclusion in the National Register (Glassow and Kornfeld 1980).

In December 1987, four isolated artifacts were discovered during an intensive inventory of part of the site's surface. Two manos noted in the southeast corner of the Cypress Ridge terrace were considered to be related to occupation at SBa-1117 (Weaver 1987). In January 1988, the U.S. Forest Service conducted archaeological monitoring for geotechnical explorations in the SLC-7 project area. Lithic artifacts, including possibly utilized flakes, were noted in an area north of the recorded boundaries of SBa-1117. It was then recommended that the boundaries be enlarged to include the newly discovered artifacts. Additional materials were observed north of the previously recorded boundaries again during the April 1988 inventory completed by Environmental Solutions, Inc. They included chert bifaces, manos, chert flake scrapers, one flake of black obsidian, chert flakes, and fragments of abalone shell.

Crest of Cypress Ridge

One large site (SBa-1941) and an isolated find have been recorded near the top of Cypress Ridge. Most artifacts were observed in the dirt road near the crest of the ridge, indicating that subsurface deposits may be present in several places. A high frequency of manos indicates that most artifacts were probably deposited during the Early Period (ca. 6000 to 1000 B.C.).

SBa-1941 was recorded in 1985 and is described as a "scatter of lithic waste and groundstone artifacts over a large area." The boundaries of this site have been enlarged as a result of the 1988 inventory. Subsurface testing is necessary to delineate its boundaries and the relationship of deposits. The occurrence of biface manos and one trifacial mano in the recently recorded upper area of the site indicates an Early Period (pre 3000 years B.P.) occupation.

Area West of the Coast Road

Between the two previously identified sites, SBa-1105 and SBa-1783, the Environmental Solutions, Inc. inventory identified two small areas with historic artifacts consisting of shells, flakes, and burned rock, which may indicate the presence of buried site areas. The historic artifacts are the result of recent use of the area.

SBa-1783

SBa-1783 was recorded in 1983 on the basis of surface observations of a concentration of shells and flakes bisected by the railroad cut. Surface distribution of flakes indicates the possible presence of buried deposits between SBa-1783, SBa-1114, and SBa-1686. Flakes and several

pieces of weathered Mussel shell were also found during the 1988 inventory in the area between SBa-1783 and SBa-1149. Subsurface testing is necessary to define the boundaries of SBa-1783, SBa-1149, and SBa-1686 and to identify possible buried sites in the area.

Proposed Manzanita Road Borrow Site

Site SBa-2216 has been recorded in the area around the existing gravel quarry. Various artifacts, including flakes of chert, cobble hammers of quartzite and other stones, a large, dense sandstone mano, a possible mano, and hammerstones were observed on the ground surface. The site, located on a ridge, is apparently the remains of an Early Period site and may be associated with similar nearby sites SBa-246, SBa-924, and SBa-925. The soil is light brown and sandy (perhaps Orcutt sands) and appears to be fairly stabilized. On the north side of the quarry site are piles of soil five to ten feet high which appear to be the topsoil scraped off prior to quarrying. These piles may contain cultural materials.

3.9.2.4 SLC-6

Modifications to the SLC-6 site for the Titan IV/Centaur program would occur in previously disturbed areas where archaeological resources may have been removed or covered and, therefore, were not included in the 1988 surface inventory. The areas adjacent to the SLC-6 site that were not previously disturbed and were included in the surface inventory are described in Section 3.2.9.3 (sites SBa-1686, SBa-1149, SBa-1114, and SBa-1117).

3.9.2.5 Boathouse Flats

Oil Well Canyon

Where Oil Well Canyon exits onto the coastal plain near the Coast Road, there is a cluster of sites, apparently occupied primarily during the Early Period (ca. 7000-1400 B.C.). Sites SBa-712, SBa-1117, SBa-1544, SBa-1547, SBa-1543, SBa-1545, and SBa-1546 are members of a group of contiguous sites that has been designated the Oil Well Canyon Site Cluster (Glassow and Kornfeld 1980). In the statement of significance of these sites, it is stated that all appear to be eligible for inclusion in the National Register (Craig and Glassow 1978).

Sites SBa-1117 and SBa-1149, discussed previously, may both be part of the site complex since they were both apparently occupied during the Early Period. It has been suggested that SBa-1117 may be connected with and part of SBa-1547 (Spanne 1983). SBa-1547 includes at least two shell middens and at least half a dozen flake and artifact concentrations.

There is almost continuous site along lower Oil Well Canyon. Previously identified SBa-1546, SBa-1545, SBa-1561, and SBa-1560 either cross or are near the Boathouse Flats site boundaries. On the basis of surface examination, limited subsurface testing, and several radiocarbon dates, it appears that all or most of the sites identified in the Oil Well Canyon cluster between the Coast Road and the beach were occupied during the Early Period (Craig and Glassow 1978; Glassow and Kornfeld 1980).

Upper Oil Well Canyon

Where the road crosses Oil Well Canyon there is running water. Buried site deposits may be contained in stream terraces.

North of Coast Road in the Vicinity of Boathouse Flats

Site E-60 is north of SBa-1111 and south of D Road. Three isolated flakes and one probably recent fragment of abalone shell were observed during the 1988 inventory.

Site SBa-1111 is recorded as being on both sides of the Coast Road, extending west from Sudden Road toward Oil Well Canyon. It was described in 1976 as exhibiting moderate to heavy density of large chipping waste, with large cores and hammerstones, primarily a quarry with some evidence of limited habitation (Glassow et al. 1976).

During the 1988 inventory, the main chert deposit was noted near the intersection of D Road and Coast Road. Many bedrock outcrops of brown banded Monterey chert were observed on the inland side of Coast Road at SBa-1111. No definite flakes were found on the south side of the Coast Road, but there were fragments of abalone shell, mostly in one concentration, and a sherd of porcelain. This area is in the vicinity of the railroad tracks and may be the remains of a railroad construction camp.

Boathouse Flats Construction Site

Five isolated finds were noted on the inland side of the External Tank Tow Route. Because there is abundant natural chert here and to the north, it is probable that most of the isolates represent naturally broken rocks and are not prehistoric tools or flakes. Archaeological sites are clustered at the mouth of Oil Well Canyon and along the cliff overlooking the ocean. Those at the cliff apparently do not extend more than 50 meters inland. The sites along Oil Well Canyon do not extend southeast more than 100 to 200 meters from the creek.

One new archaeological site was identified at the Boathouse Flats site during the 1988 inventory (E-69). The new site is located near the bluff edge between the coast and previously recorded site SBa-1560 and is indicated by the presence of low density concentrations of chert flakes and shells. Between E-69 and SBa-1560, low density concentrations of weathered shellfish fragments and occasional chert flakes were found along the south side of Oil Well Canyon.

From E-69 east, shells were found sparsely scattered along the ocean cliffs extending to the Boathouse in an area along the southern boundaries of the Boathouse terrace. Also along the edge of the cliffs are prehistoric site SBa-636 and historic dump site SBa-1558. SBa-636 is a prehistoric site located along the coast, defined on the basis of surface observations of chert flakes and shells. Historic site SBa-1558, an old Coast Guard dump, has been recorded near the southwestern corner of the site.

SBa-1542 was apparently a chert quarry, located along the eastern edge of the site. Excavations were conducted here as part of a data recovery program to mitigate impacts related to construction of the External Tank Tow Route. The data recovery program and report concluded that quarrying at the site was to obtain large flakes (Rudolph 1984) for gunflints during the 1769 Portola expedition.

3.9.2.6 Vina Terrace

Access Road, Utility Corridor, and Water Line

The 1988 cultural resources inventory found a three-centimeter, light brown Monterey chert primary flake near the point where the proposed road begins to ascend to Cypress Ridge. Along the crest of Cypress Ridge, the proposed road passes through SBa-1941. In 1984, one chert flake

was found near the end of the present Spur road overlooking the Vina Terrace site. The isolated flake indicates the possible presence of a buried site. Chert outcroppings in the area of Vina Terrace may have been a material source.

Vina Terrace Construction Site

Several isolated artifacts were found in the proposed construction site, some of which may indicate the presence of subsurface site deposits. The chert flake found in 1984, described above, is within this area. Other finds include a small isolated piece of a thin clam shell which may be modern or fossil, and a black chert secondary flake two to three centimeters long found in a dirt road east of Coast Road. This flake may be natural.

3.9.2.7 Utility Corridors

This section presents descriptions of archaeological sites, and areas which may contain buried sites, according to their location in proximity to components of the proposed action, such as power and pipeline corridors. The access roads and utility lines that are assumed to be associated with the alternative project sites (excepting the SLC-6 alternative) would join the corridors associated with the Cypress Ridge site a short distance north of the Lockheed temporary storage facilities along the Coast Road west of SLC-6. Implementation of the SLC-7 project at either the Cypress Ridge, Boathouse Flats, or Vina Terrace locations would have the same effect on the cultural resources sites discussed below.

SBa-654

Site SBa-654 is described in a previous report as having maximum dimensions of approximately 360 meters by 200 meters. The site deposit is described as having a light density of flakes and artifacts, some shell, and a rock concentration. One piece of bone and one artifact were found (Glassow et al. 1976).

SBa-551

Site SBa-551 was described in the same report as having maximum dimensions of approximately 500 by 170 meters. The constituents include shell, chipping waste, mammal bone, fishbone, and a number of diagnostic artifacts such as projectile points and beads. Features include a cluster of sea

mammal bones, and a burial indicates the possible presence of a cemetery. Carbon dates and diagnostic artifacts indicate occupation at the site between 100 B.C. and A.D. 1400 (Glassow et al. 1976).

South of the main SLC-6 complex and in the vicinity of the Coast Road are apparent buried archaeological deposits. One area of buried deposit, discovered during construction of the N Road, is described in Section 3.9.2.2.

SBa-1679

Site SBa-1679 may extend into the power corridor and may have subsurface components. The site is recorded on the basis of surface observations, with observed concentrations of moderate to light density weathered mussel shell fragments, stone tools, and chert flakes. The site surface is similar to SBa-662, described below.

SBa-662

SBa-662 was described in an early report on sites in the South VAFB area. The site is large, approximately 330 by 230 meters, and includes shell, chipping waste, rock, and bones of fish, sea mammal, and land mammal. The types and frequencies of artifacts vary, and there is a near-absence of projectile points. Features include human burials in two areas, a possible house floor, and a rock concentration. This was one of the larger sites excavated and probably served as a seasonal or permanent village. Other artifacts included a fishhook, mano-metate fragments, mortar-pestle fragments, and shell beads. The latter indicate Middle Period occupation and a carbon date from a lower level indicates occupation around 700 B.C. (Glassow et al. 1976). The site is mostly intact.

An isolated flake is indicated in the vicinity of the corridor on VAFB archaeology base maps, north of the SLC-6 complex and near the edge of a small canyon. This flake, located during a 1974 inventory, plus other artifacts found on the same ridge, may indicate the presence of a buried site.

SBa-1109

Site SBa-1109 was described in 1976 (Glassow et al. 1976). A railroad cut divides this site. It appears that the site extends east and connects with SBa-1105; a few artifacts were observed in this area. Northwest of the cut is a shell midden area. Most shell is from mussels, although some is from abalone and acorn barnacles. Northwest of the cut, a mano, pestle, and a large quantity of chert flakes were observed.

SBa-1105

Site SBa-1105 apparently contains two concentrations of artifacts and shells; one at the eastern edge, which is crossed by the power line corridor, and the other on a lower terrace to the west. The upper area contains relatively high densities of shells and flakes. Bone is also present. This site was described in 1976 (Glassow et al. 1976).

3.9.2.8 Paleontology

Cypress Ridge

The Cypress Ridge site is located on a sloping marine terrace, overlain by a veneer of soil and colluvium. Underneath lies as much as 70 feet of silty sand, comparable to the Orcutt Sands and with a low potential of containing significant paleontological resources (Woodring and Bramlette 1950). Bedrock in the vicinity of Cypress Ridge is Monterey Formation, which has moderate potential to contain vertebrate fossils (USAF 1987a). Paleontological sites, which find exposure in rock outcrops, road cuts, or other unvegetated exposure of vertical profiles, are uncommon at Cypress Ridge. Deposits have usually been found sporadically so are not expected to occur in great densities (Gray 1985). Definitive determination of the presence of fossils at the Cypress Ridge would require excavation.

SLC-6

The SLC-6 site is located on a sloping marine terrace between 200 and 500 feet above sea level adjacent to the lower slopes of the Santa Ynez Mountains. Underlying the site is a mix of sands, loams, clays, and undifferentiated soils. Paleontological resources near the surface prior to existing SLC-6 construction would have been either removed or disturbed due to construction activities.

Boathouse Flats

Located on the western end of the Sudden Flats terrace, the terrestrially derived sediments at this site are more likely to yield vertebrate fossils than are those at the Cypress Ridge site. The terrace has yielded mammoth and horse remains less than two miles to the east, and the Boathouse Flats site may contain significant resources. As the only vertical exposures are along the coastal bluff, excavation would be required for examination of the rest of the site. It is less likely that significant paleontological resources exist in the underlying Monterey shale formation.

Vina Terrace

Relative to the other three sites, Vina Terrace can be characterized as an older, higher marine terrace with terrestrial colluvium and sand, on the Monterey Formation wave-cut shelf. These conditions are similar to Cypress Ridge, but the overlying unconsolidated sediments are thinner. The possibility of encountering paleontological resources is low in the sediments, while moderate in the Monterey Formation.

3.10 TRANSPORTATION

3.10.1 REGIONAL ENVIRONMENT

3.10.1.1 Lompoc and Vicinity

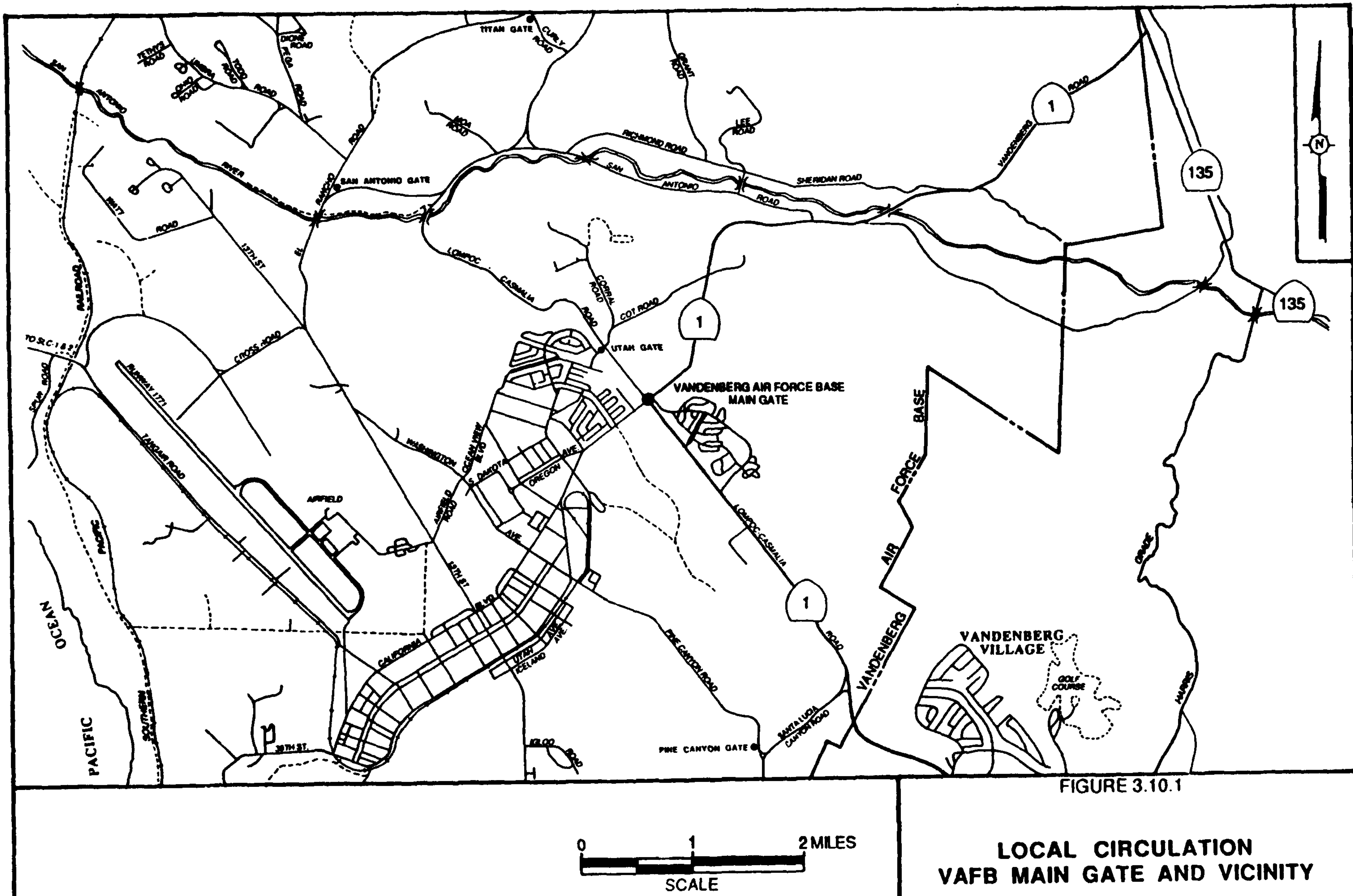
The transportation system potentially affected by the proposed SLC-7 project primarily would be the highways surrounding the city of Lompoc and VAFB and surface streets within the city of Lompoc. The main transportation routes within the Lompoc area are State Routes 1 and 246. Each of these highways connects with U.S. Highway 101, the main north-south transportation corridor in the region. From north of the Lompoc area, State Route 1 provides access to VAFB through the Main Gate. The main transportation corridors in Lompoc, "H" Street, Ocean Avenue, and Central Avenue, are indirectly impacted by traffic to and from the VAFB entrances. The major routes in the area are shown in Figure 3.10.1 (Local Circulation, VAFB Main Gate and Vicinity) and Figure 3.10.2 (Local Circulation, Lompoc and Vicinity).

State Route 1 is a two-lane, rural expressway approaching Lompoc from the south. Route 1 follows East Ocean Avenue and North "H" Street within the city of Lompoc and continues north from the city as Lompoc-Casmalia Road. It merges with State Route 135 south of Santa Maria (SBCCAPC 1987b).

State Route 246 is a two-lane, rural highway connecting the Lompoc area with Highway 101 and the Santa Ynez Valley to the east and VAFB to the west. Inside the city of Lompoc, Route 246 becomes Ocean Avenue. Two VAFB entrance gates, South Gate and 13th Street Gate, are located at an intersection on Route 246 west of the city of Lompoc (SBCCAPC 1987b).

Ocean Avenue is a major, east-west, four-lane, divided road through southern Lompoc. As one of the main transportation routes connecting Lompoc with VAFB, Ocean Avenue has an average maximum of 16,000 vehicles per day (SBCCAPC 1987b).

"H" Street is a major, four-lane, divided road that runs north-south through the city of Lompoc. Parts of "H" Street carry the heaviest flows of traffic for Lompoc during an average day, sometimes approaching 30,000 vehicles per day.



SOURCE: USAF STRATEGIC AIR COMMAND, MASTER PLAN GRID 1986.

FIGURE 3.10.1

LOCAL CIRCULATION
VAFB MAIN GATE AND VICINITY

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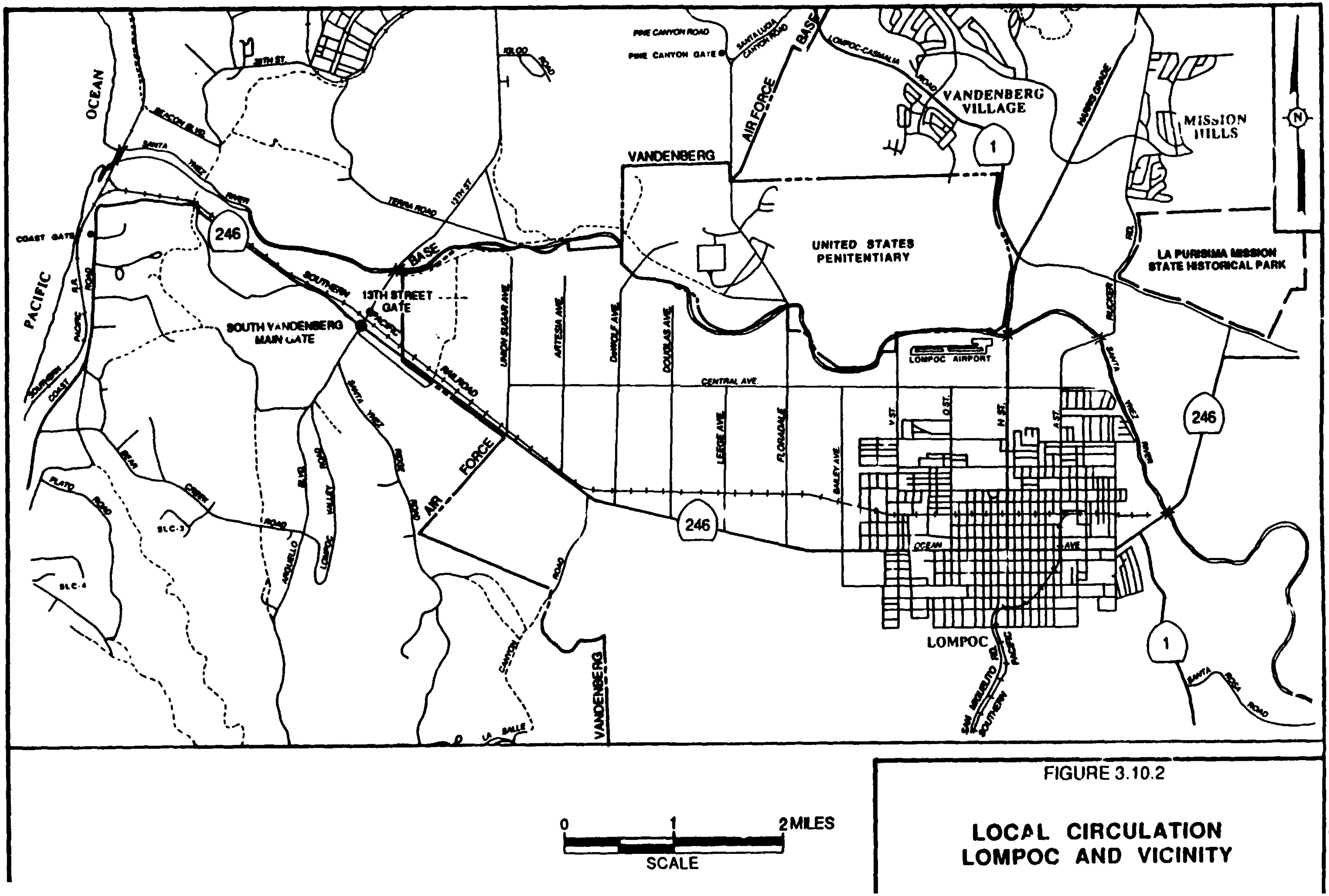

FIGURE 3.10.2

LOCAL CIRCULATION LOMPOC AND VICINITY

Central Avenue is a two-lane, undivided street running east-west through the northern part of Lompoc. This street carries an average maximum of 10,000 vehicles per day. For people traveling from areas north of Lompoc, such as Vandenberg Village and Mission Hills, it serves as the route to follow in reaching western Ocean Avenue (Route 246) and the VAFB South Gate (SBCCAPC 1987b).

In addition to the direct route leading to Ocean Avenue, Highway 1 also leads indirectly into Ocean Avenue. From the south, Highway 1 intersects Highway 246 just inside the Lompoc city limits. From the north, Highway 1 flows into Lompoc, then becomes "H" Street, which intersects Ocean Avenue in south Lompoc.

Key intersections in or near the city that might be affected due to increased traffic associated with the SLC-7 project would be the intersections of Highway 1/Highway 246, "H" Street/Ocean Avenue, "H" Street/Central Avenue, Highway 246/Union Sugar Avenue, and Highway 246/South Gate VAFB. Other intersections along Ocean Avenue also have the possibility of being affected (City of Lompoc 1988b). At the present time, these intersections are listed as having Level of Service (LOS) values of A (extremely favorable progression with very low delay) or B (good progression and stable flow with occasional delay). Normal Intersection Capacity Utilization (ICU) values and their corresponding LOS values are listed in Table 3.10.1 (Intersection Capacity Utilization and Level of Service Values).

3.10.1.2 VAFB

Four gates provide public access to VAFB. These are the Main Gate off of State Route 1 north of Lompoc, the South Gate and the 13th Street Gate located off of Highway 246, and the Pine Canyon Gate located at the end of Pine Canyon Road.

Peak traffic at the four gates occurs between 6:30 and 8:30 a.m. and between 3:30 and 5:30 p.m., with the greatest volume at the Main Gate. Pine Canyon also has a significant increase in traffic during peak hours. Traffic at the other two gates is not significantly affected. It is anticipated that the South Gate entrance would be most widely used by traffic associated with SLC-7. The main route to the South Gate is from Highway 246 (USAF 1987a).

TABLE 3.10.1

INTERSECTION CAPACITY UTILIZATION AND LEVEL OF SERVICE VALUES

LEVEL OF SERVICE	TRAFFIC FLOW CHARACTERISTICS	ICU RANGE[1]
A	Extremely favorable progression with little delay. Most vehicles do not stop at all.	.00 - .60
B	Good progression and stable flow with an occassional approach phase fully utilized.	.61 - .70
C	Satisfactory operation with fair progression and longer cycle lengths. Individual cycle failures may begin to appear.	.71 - .80
D	Tolerable delay where congestion becomes noticeable and many vehicles stop.	.81 - .90
E	Unstable flow with poor progression and frequent cycle failures.	.91 - 1.00
F	Oversaturation with arrival flow rates exceeding the capacity of the intersection. Considered unacceptable to most drivers.	1.01+

[1]Intersection Capacity Utilization (ICU) values are used for signalized intersection applications.

Source: City of Lompoc 1987.

3.10.2 LOCAL ENVIRONMENT

3.10.2.1 Cypress Ridge

Traffic would arrive at the site primarily through the South Gate, then continue to Arguello Road, Bear Creek Road, Coast Road, and the site. The Air Force does not keep LOS values for these roads, but the LOS has been observed to be very good due to lack of appreciable traffic in the area. Traffic volume in the vicinity of Cypress Ridge is very low, as there is little USAF activity in the area.

3.10.2.2 SLC-6

Traffic would arrived at SLC-6 by following the same routes as for the Cypress Ridge site. Entrance to SLC-6 could be gained via two separate gates. Currently, only one of these gates is being used, due to the low volume of traffic entering the site. If the SLC-6 site were to be reactivated, the front gate located near the POV parking area would be used for personnel access, and the north gate would be used for truck deliveries. In general, traffic volume in the vicinity of SLC-6 is relatively low due to little other USAF activity in the area. No LOS values are available, but the LOS has been observed to be good due to lack of appreciable traffic.

3.10.2.3 Boathouse Flats

Traffic conditions at the Boathouse Flats site would be similar to those at the Cypress Ridge site.

3.10.2.4 Vina Terrace

Traffic conditions at the Vina Terrace site would be similar to those at the Cypress Ridge site.

3.11 HEALTH AND SAFETY

The regulatory environment for health and safety issues consists of those regional and local elements and practices which have been established to minimize or eliminate potential risks to the general public as a result of operations at VAFB. These elements and practices form the baseline from which a Risk Assessment for the proposed action has been prepared (Environmental Solutions 1988f).

For purposes of this section, the regional environment consists of Santa Barbara County in general and the nearby community of Lompoc in particular. The local environment is defined as VAFB. The site-specific environment will consist of the Environmental Study Area, as shown in Figure 3.3.2, and include the proposed Cypress Ridge site, plus the alternative SLC-6, Boathouse Flats, and Vina Terrace sites. For this discussion, these four sites will not be differentiated.

3.11.1 REGIONAL ENVIRONMENT

Santa Barbara County is preparing a Draft Hazardous Materials Response Plan that will be used for county-wide disaster response. The estimated date of completion is April 1989. VAFB is acting as a reviewer during preparation of the draft plan. Cities in Santa Barbara County will also act as reviewers once the draft plan has been completed.

Cities and local communities in Santa Barbara County are required to have their own emergency response plans, which will be incorporated by the county into a comprehensive Multihazard Functional Plan. This plan will specify actions to be taken in case of a local disaster. This plan is still in draft form and is scheduled for completion in April 1989.

Pre- and post-launch operations, as well as actual space vehicle launches and other USAF functions at VAFB, have the potential to affect not only the health and safety of personnel within the confines of VAFB, but also the general public within proximity to VAFB. Due to the magnitude of VAFB operations and the spatial distribution of potential risk activities, VAFB plays a prime role in regional emergency planning.

The Hazardous Materials Response Plan will be implemented in case of an emergency and will be directed by a county Hazardous Materials Coordinator, who will coordinate the various agencies involved with emergency response, including:

- Santa Barbara County Fire Department.
- Santa Barbara County Sheriff's Department.
- State Park Department.
- California Highway Patrol (CHP).
- Local law enforcement and fire departments.

Local agencies will supplement the county agencies as necessary, depending on the severity of the emergency.

The city of Lompoc and VAFB have entered into a mutual aid agreement. This agreement allows emergency units from either Lompoc or VAFB to provide mutual assistance in the event of an emergency. A "hotline" exists between VAFB and the city of Lompoc and is used by VAFB to immediately notify the city of Lompoc in case of a major accident on the base. In the event of an emergency involving a missile mishap in Lompoc, VAFB would assume control and could set up a national defense area if protected material were involved in the accident. Air Force Regulation 207-1 provides for circumstances involving protected priority material by allowing national defense areas to be established by the military. The military would then have control over all activities in the area. The city of Lompoc would provide services as requested by VAFB.

In the event of a missile mishap impacting other areas outside of VAFB, the On-scene Disaster Control Group from VAFB would respond to the accident upon request of the county. County agencies would be used to help in evacuation and possible fire control for such incident. Military personnel would assume responsibility for disaster control in the immediate impact area.

Danger zones have been established off the Santa Barbara County coast between Point Sal and Point Conception. These zones were established to meet security requirements of the USAF Western Space and Missile Center (WSMC) and reduce the hazard to persons and property during a launch or related activity. The area is divided into nine zones that can be selectively closed to maritime traffic. If zone closures become necessary, they are announced daily over various radio frequencies and posted in harbors along the coast.

Another procedure commonly practiced is closure of Jalama Beach County Park on the day of a launch from South VAFB. The beach lies within the WSMC Range Safety Zone that has been calculated for South VAFB launches. Even though direct overflight of Jalama Beach does not

normally occur, there is the possibility of debris from a launch anomaly impacting the beach. In order to protect people using the park, there is an agreement between VAFB, the County Parks Department, the County Sheriff, and the California Highway Patrol to close the park upon request of VAFB during missile launches.

3.11.2 LOCAL ENVIRONMENT

Safety regulations on VAFB are administered by the 1st Strategic Aerospace Division (1STRAD) and the WSMC Range Safety Group. The efforts of these two groups are coordinated to ensure that safe policies at VAFB are followed. The 1STRAD safety regulations are general in nature to allow for flexibility to cover procedures for the entire base. The WSMC safety procedures follow those of 1STRAD closely, but are more detailed and relate more closely to Western Test Range (WTR) use. The WTR is a sub-unit to WSMC and includes all VAFB Air Force Systems Command launch and support facilities. Any test launches fired by 1STRAD are also supported by WSMC and WTR for down-range launch operations. Under this agreement, VAFB is considered the host and WSMC the tenant. WSMC is responsible for safety on the WTR and must ensure that all WTR users follow the correct safety guidelines. The WTR user is defined as any military or civilian organization or federal government agency that requires the use of WSMC WTR facilities.

3.11.2.1 1STRAD Safety Procedures

Regulations pertaining to base safety are contained in 1STRAD 127-200, Missile Mishap Prevention Regulations (USAF 1976a). The various categories documented in the regulations are: (1) General Base Safety, (2) Hazardous Materials Safety, (3) Special Safety Procedures, (4) Missile Operations, (5) Task Supervision/Surveillance, (6) Missile Mishaps, and (7) Safety Inspections and Surveys. Hazardous material, missile operation, and missile mishap safety procedures are designed to protect the public should an emergency occur during normal daily operations or vehicle launch.

General Base Safety

General base safety procedures relate to various aspects of personnel and equipment safety. These include protective clothing, protective equipment, personnel warning devices, personnel safety eye baths, smoking areas, minimum visibility and/or lighting, meteorological conditions, communication requirements, fatigue precautions, use of cranes and hoists, spark arrestors, corrosion control, vehicle wheel chocking procedures, and personnel viewing areas/requirements.

Hazardous Materials Safety

Hazardous materials safety procedures deal with toxic propellants. They explain the proper techniques and protective devices for transferring and handling propellants. Trained supervisors and other personnel connected with activities involving propellants are considered essential in preventing accidents. Personnel training includes instruction in:

- Nature and properties of the propellants.
- Materials that are compatible with the propellants.
- Protective clothing and equipment to be used with the propellants.
- Safety, self-aid, and first aid instructions.
- Safe disposal procedures.
- Importance of electrically grounded equipment.
- Explosive potential of the propellants.
- Protective measures for explosives handling, as prescribed by industrial safety rules.
- Requirements to wear non-static producing clothing, if appropriate.

Any movement of the propellants on- or off-base is considered a hazardous material movement and is handled accordingly.

Special Safety Procedures

Special safety procedures include appropriate methods for: (1) working with pressurized systems, (2) welding, (3) storage tank entry, (4) entry into oxygen deficient/enriched atmospheres, (5) working with ionizing, laser, and microwave radiation, and (6) determination of Toxic Hazard Corridors (THCs) prior to propellant transfers or handling. Utilizing localized meteorological data, THCs predict where a cloud of toxic gas would drift if released to the atmosphere. THCs are generated using cold spill air distribution computer models. These models are based on a sudden release of toxic fumes and use a Gaussian Puff Dispersion Algorithm to determine the location of the THC. If the THC shows the potential for impact to uncontrolled areas, then transport/handling operations are postponed until meteorological conditions are such that the THC no longer encompasses an uncontrolled area.

Hypergolic Transportation Safety

As hypergolic propellants are toxic by nature, the utmost in care is used in their shipping. Hypergolic propellants are shipped using licensed and DOT-approved tanker trucks. The route followed to VAFB through Santa Barbara County is described below:

> State Route 166 south from the San Luis Obispo County/Santa Barbara County border to U.S. Highway 101, bypassing Santa Maria. South on U.S. Highway 101 to State Route 246, east of Lompoc. State Route 246, west toward Lompoc to Purisima Road, to State Route 1. State Route 1, northwest to Santa Lucia Canyon Road. West on Santa Lucia Canyon Road to the Pine Canyon Gate where VAFB is accessed.

Projects on VAFB which plan to use hypergolic fuels in large quantities are the Titan II Program at SLC-4 West and the Titan IV program at SLC-4 East. The Titan II program will require 12 shipments of fuel and 18 shipments of oxidizer per year (USAF 1987c). The Titan IV program will require 10 fuel shipments and 18 shipments of oxidizer per year (USAF 1988b).

The propellants, which are delivered from the manufacturers in Mississippi and Alabama, have been shipped to VAFB since 1958. The potential risk associated with transporting hypergolic propellants is relatively low, estimated at 1.56 accidents per million round-trip vehicle miles traveled between the manufacturing plants and VAFB. An accident (an unplanned event) does not necessarily result in a tank rupture or spill (see Risk Assessment, Environmental Solutions 1989f). Special construction of the tanker vessels reduces to a minimum the overall chances of a spill or rupture occurring during a transportation accident. At the current rate of about 60 shipments per year, it would take more than five years to accumulate one million round-trip miles (Madrone Associates 1981).

The preferred location for propellant delivery to VAFB is the Pine Canyon Gate, as shown in Figure 3.10.1. The regional roadway network is shown in Figure 3.11.1 (Santa Barbara County Propellant Transfer Routes).

U.S. Department of Transportation (DOT) regulations in the Code of Federal Regulations (49 CFR 100-199) restrict the type and quantity of hazardous substances to be transported. Santa Barbara County and VAFB have worked together to train county personnel in the handling of hazardous materials such as hypergolic propellants. Hospitals in the area have been notified of medical expertise available at VAFB regarding propellants (Madrone Associates 1981).

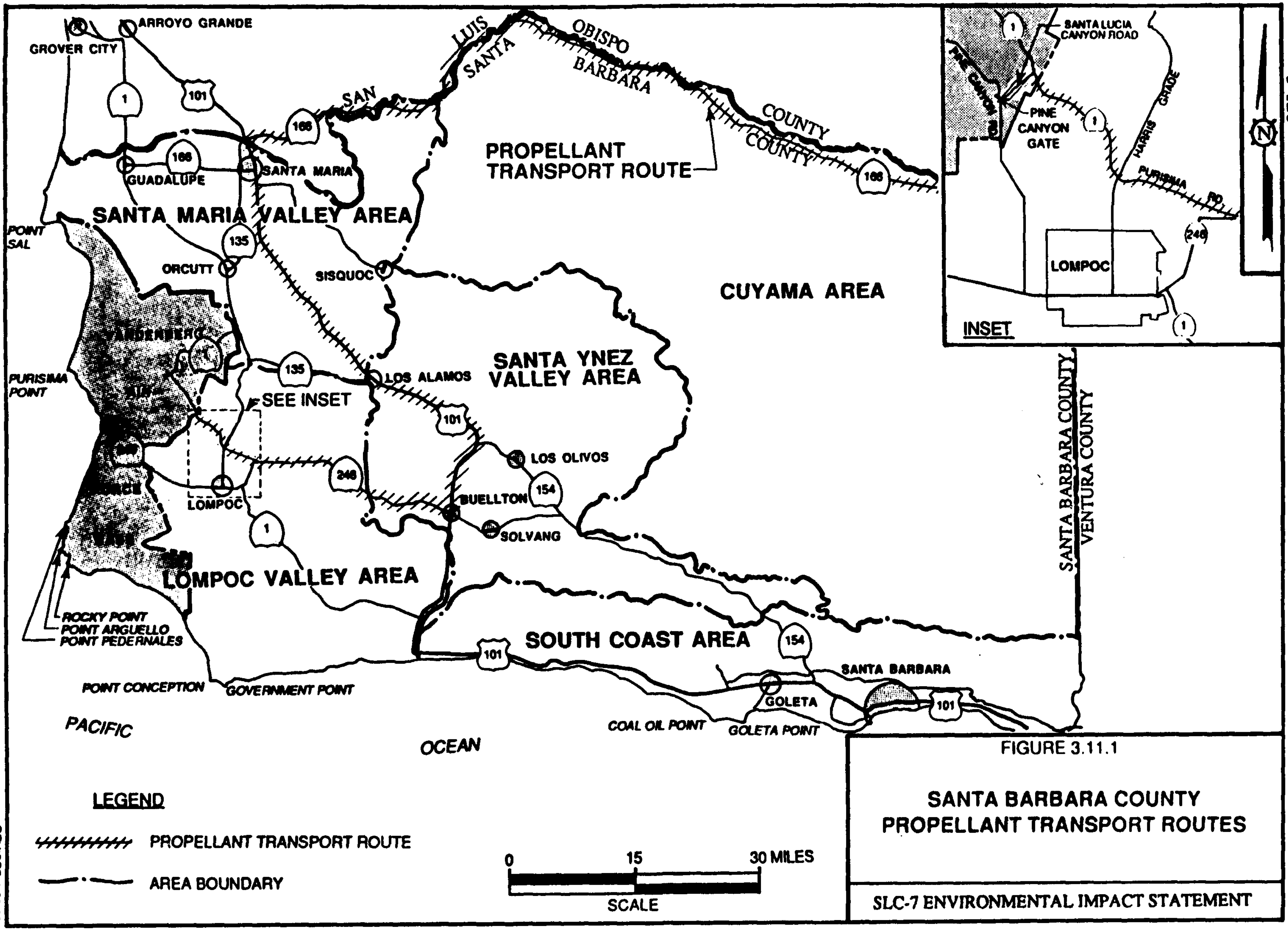

FIGURE 3.11.1

SANTA BARBARA COUNTY
PROPELLANT TRANSPORT ROUTES

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Before propellant transfers occur in the area, the California Highway Patrol (CHP) or other proper authorities are notified so that appropriate measures can be taken to protect the general public from an accidental spill. Two CHP cars currently escort propellant transport vehicles as they travel through California to VAFB.

Missile Operations

Missile operations include provisions for scheduling hazardous/dangerous launch operations, designating safety control areas, using vehicles in safety control areas, and training personnel for activities in safety control areas.

Hazardous/Dangerous Launch Operation Precautions

Hazardous/dangerous launch operation precautions include the following:

- Publication of a specific launch support plan.
- Formal briefing for launch support team and other appropriate agencies.
- Activation of appropriate size safety control areas (missile flight hazard/caution areas) and potential THC (when applicable).
- Activation of appropriate personnel warning lights (i.e., Amber-Hazardous Operations, Red-Dangerous Operations).
- Appropriate clearance of the missile flight hazard/caution areas and proper alert or evacuation of facilities within the THC (when applicable). If the THC encroaches into an uncontrolled, populated area, the operation is postponed until meteorological conditions are such that the THC no longer encompasses an uncontrolled area.
- Presence of emergency support team personnel.
- Implementation of specific post-launch safety procedures.

Scheduling of Hazardous/Dangerous Launch Operations

Scheduling of hazardous/dangerous launch operations is handled through the 1STRAD Missile Test Support Scheduling Branch. The appropriate support personnel are notified as to the time of the operation, enabling safety precautions to be initiated.

Safety Control Areas

Safety control areas are locations that potentially could be impacted by a hazardous/dangerous operation. Access to these areas is rigidly controlled during all hazardous/dangerous launch operations to prevent personnel or equipment from being exposed to high risk situations.

Training for Personnel in Safety Control Areas

Training requirements for personnel in safety control areas include:

- Personnel must understand the hazards involved.
- Personnel must be trained in the use of necessary protective equipment.
- Personnel must understand all evacuation procedures and routes.
- Security police support personnel and the Operation Team Chief must understand the location of authorized personnel in the safety control area.
- Emergency support specialists must be familiar with the facility involved in the operation in order to be able to perform rescue operations under emergency conditions.

Task Supervision/Surveillance

Task supervision/surveillance is controlled by individual task supervisors who are responsible for all aspects of a specific task or operation, including safety. The task supervisor uses safety checklists, safety holds on the launch, and surveillance techniques in order to ensure that all safety aspects of the task or operation are met.

Missile Mishaps

Missile mishaps (i.e., accidents involving any missile operation) are handled by various 1STRAD emergency support teams. These teams follow specific procedures for operations pertaining to missile mishaps. Some of these procedures include authorization to enter an accident area, control procedures for stopping trains, and salvage procedures.

Emergency Support Teams

Several distinct teams of qualified individuals are used to respond to emergencies that might occur during a missile operation. These teams are:

- Specialized Operations Support Team. This team provides response to an emergency occurring during hazardous/dangerous non-launch operations.
- On-scene Disaster Group. This team augments and supports the specialized operations support team. In case of an off-base missile impact, the commander of this team would lead a missile accident convoy to the impact point.
- Missile Potential Hazard Team. This team assumes control in the unusual situation of a missile becoming uncontrollable due to data, equipment, or personnel limitations. This team would stay in control until return of the missile to a stable condition.
- Launch Support Team. This team is responsible for holding damage or injury to a minimum in the event of an emergency during a missile launch.

Missile Mishap Procedures

The missile mishap procedures include the following:

- Authorization To Enter Missile Accident Area. Access to the area is controlled by security police. Only authorized personnel are allowed entry.
- Control Procedures for Train Stoppage. In the event missile debris or parts block the Southern Pacific Railroad tracks, security police would stop the train to warn the engineer of the danger and then let the train proceed at its own risk.
- Salvage Procedures. These provide for missile debris and parts to be searched for and salvaged in the appropriate manner.

Safety Inspections and Surveys

Safety inspections and surveys are also used as a check to ensure that the proper level of safety is being maintained at all times on VAFB. Representatives from various safety and health agencies located on VAFB perform these inspections and surveys.

3.11.2.2 WSMC Range Safety Procedures

WSMC Range Safety closely follows 1STRAD safety regulations and incorporates its own regulations into specific areas regarding launch and pre-launch activities. The WSMC Commander is the final authority for safety at WSMC and the WTR. Regulations 127-1 and 127-2 establish the policies and safety procedures to be followed by the range users. The WSMC safety requirements are divided into five basic areas, as published in WSMC 127-1: (1) Flight Analysis, (2) System Ground Safety, (3) Flight Termination and Tracking Transponder Systems, (4) Space and Missile Systems Ground Operations, and (5) Missile Launch Operations. Range users must satisfy the requirements in each area prior to obtaining approval for launch, as discussed below:

Statement of Program Acceptance (SPA)

The user provides mission concepts, general vehicle/payload description, propellant characteristics, siting issues, mission scenarios, trajectory data, turn rates/capabilities, break-up data, and impact characteristics. WSMC Safety reviews the data and, if the program concept is acceptable, issues the SPA.

Flight Plan Approval (FPA)

The user submits data to WSMC that expands and details the SPA data to include intended launch dates, expanded vehicle/payload hazard data, destruct system data, tracking aids, propellant definitions, more detailed trajectory data, break-up data, buoyancy analysis, and probability studies, as required. Upon review and approval, WSMC Safety issues an FPA.

Missile System Ground Safety Approval (MSGSA)

The user submits data describing missile system operation/functions, support equipment and facilities, handling equipment, and applicable hazard data relating to noise, radiation, toxic materials, propellants, pressure systems, ordnance systems, electrical/electronics, software safety, and processing procedures. This information is compiled as an Accident Risk Assessment Report and reviewed along with the project System Safety Program Plan and Launch Complex Safety Plan. Upon review and approval by WSMC Safety, the user is issued an MSGSA.

Flight Termination System Approval (FTSA)

The user submits design, operation, and reliability data that will provide tracking/communication/ destruction capability. The system is required to ensure that no public and/or property damage would be incurred due to an errant missile/thrust malfunction. Upon review and approval by WSMC Safety, the user is issued a FTSA.

Operations Approval Letter (OAL)

Once all of the above approvals have been granted by WSMC Safety, and technical requirements a specified in WSMC 127-1 have been fulfilled, an Operations Approval Letter (OAL) is issued. The OAL is issued for each separate mission and specifies the vehicle and the payload.

Missile Launch Operations

The missile launch operations describe requirements and restrictions considered prior to launch. A brief description of the more important requirements or restrictions follows.

Meteorological Restrictions

Launches are not allowed if there exists an undue hazard to persons or property due to potential dispersion of hazardous materials or propagation of blast or other acoustic effects. Before any launch occurs, an air dispersion computer model, REEDM, is run. Inputs to this model include predicted launch meteorological conditions and hydrogen chloride (HCl) emission estimates from the launch facility for both normal and aborted launch scenarios. REEDM produces a Toxic Hazard Corridor (THC) and plots it in relation to the surrounding area. If the THC encompasses any unprotected populated area, the launch is put on hold until more favorable meteorological conditions exist. Figure 3.11.2 (Titan IV/Centaur Normal Launch HCl Isopleths) presents an example of the REEDM output for an anticipated SLC-7 launch.

Area Clearance

Only authorized personnel are allowed in on-base safety clearance areas during launch. Security police enforce these boundaries.

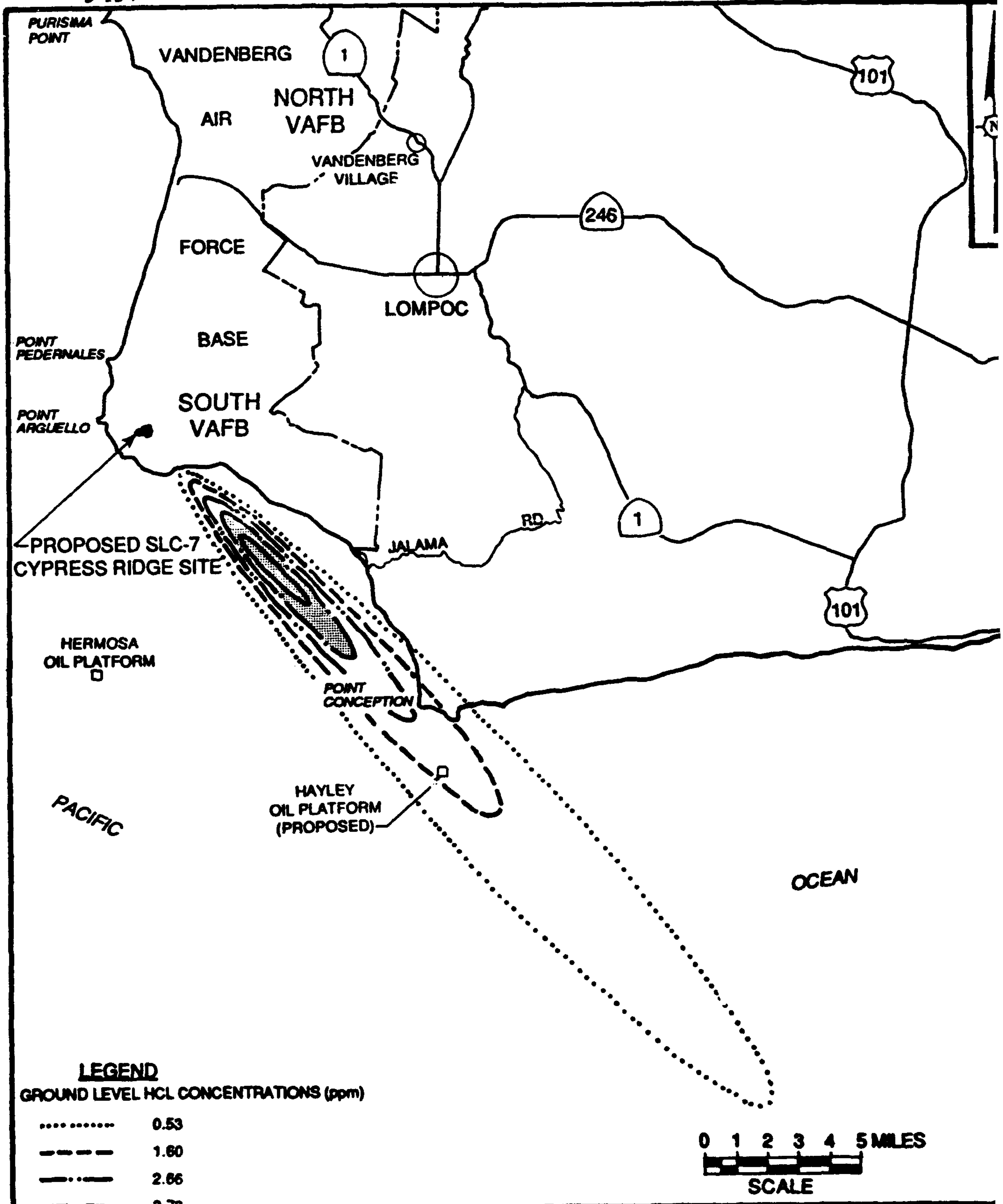

FIGURE 3.11.2

TITAN IV/CENTAUR NORMAL LAUNCH HCL ISOPLETHS

SLC-7 ENVIRONMENTAL IMPACT STATEMENT

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Flight Termination System Control

The system control console is manned by two Range Safety officers in order to provide redundancy in case the space vehicle must be destroyed. The officers monitor a computer output generated by a Launch Risk Analysis (LARA) program. This program uses data obtained in the initial flight analysis, in coordination with current meteorological conditions, to determine a destruct line. If the flight of the vehicle crosses this destruct line, it would place the surroundings in danger. Therefore, a launched vehicle on a path that would cross the destruct line is destroyed.

Launch Holds

Launch holds are used to stop the launch sequence in the event it becomes necessary because of excessive risk factors.

Flight Termination Criteria

The following criteria provide for flight termination:

- Obviously erratic flight.
- Violation of safe flight routes.
- Vehicle performance becoming unpredictable.

3.12 SOCIOECONOMICS

The influence of VAFB on employment, population, housing, and public services varies widely within Santa Barbara County. Commuting patterns for VAFB workers generally define the VAFB area of influence as the North County region, which encompasses the area north of the Santa Ynez Mountains. The area to the south is defined as the South Coast area, as shown in Figure 3.11.1.

The VAFB economic impact region consists of the area generally within a 50-mile radius of VAFB and includes most of Santa Barbara and San Luis Obispo Counties. Within the North County, VAFB economic influence centers on the Lompoc and Santa Maria Valleys. Labor force characteristics for other North County areas (Cuyama and Santa Ynez Valley) suggest that VAFB activities have a minor role in these areas. In addition, both VAFB and other employment centers in the North County draw commuters from southern San Luis Obispo County. However, these commuters are estimated to comprise less than five percent of the San Luis Obispo labor force of about 86,000 persons. Therefore, the subsequent assessment of the socioeconomic role of VAFB focuses on the Lompoc and Santa Maria Valleys. For this discussion, the proposed and alternative sites will not be discussed individually, since the regional and local environments are the same.

3.12.1 REGIONAL ENVIRONMENT

3.12.1.1 Employment

Employment in Santa Barbara County is diversified among a number of major industries. Based on 1980 census figures, predictions were made to quantify the number and locations of jobs within the county, as shown in Table 3.12.1 (Santa Barbara County Projected Employment by Region 1985). The largest employers are services, retail trade, government, and manufacturing. In part, employment in the manufacturing and services industries are attributed to electronics manufacturing and services such as the research and development firms that have been attracted to the county by defense-related and space research at VAFB (SBCCAPC 1985).

Differences in the economies of the North County and South Coast areas of Santa Barbara are represented by their respective employment structures, as shown in Table 3.12.1. Generally, North County employment is concentrated in the agriculture, manufacturing, and government sectors. Professional occupations and industries, such as services and finance/real estate, comprise a larger part of South Coast employment. The employment differences between the two

TABLE 3.12.1

SANTA BARBARA COUNTY
PROJECTED EMPLOYMENT BY REGION 1985[1]
(Percent Distribution)

EMPLOYMENT SECTOR	AGRICULTURE	MINING [2]	CONSTRUCTION	MANUFACTURING	TRANSPORTATION/ UTILITIES	WHOLESALE TRADE	RETAIL TRADE	FINANCE/ INSURANCE/ REAL ESTATE	SERVICES	GOVERNMENT	TOTAL WORK FORCE (Thousands)
Santa Barbara County	6.0	1.3	4.2	14.4	4.2	3.2	19.2	4.6	25.3	17.6	143.7
South Coast	3.1	0.4	3.2	13.7	4.2	2.9	19.6	5.7	31.0	16.2	83.0
North County											
• Santa Maria Valley	13.0	4.0	5.8	17.5	3.8	4.6	19.6	2.5	16.3	12.9	33.6
• Lompoc Valley	2.9	0.0	3.2	20.3	3.0	1.9	11.1	4.1	21.6	31.9	17.4
• Santa Ynez Valley	12.0	1.6	9.4	0.0	8.0	2.9	28.9	2.9	14.7	19.6	9.7

[1] The table reflects where jobs are located in the region, not where employees reside.

[2] Mining includes the oil and gas industry in Santa Barbara County.

Source: Santa Barbara County Cities Area Planning Council 1985.

areas are partly attributable to the role of VAFB, since VAFB workers tend to be comprised of government, manufacturing, and professional services, primarily research and development.

Offshore oil and gas resource development has been a major activity in Santa Barbara County in recent years. Seven offshore oil development and related projects, including onshore support and transportation facilities, are currently underway. To date, much of the employment has been in the construction of oil facilities and has helped to maintain a sizeable construction work force in the Santa Barbara/San Luis Obispo County region following the completion of the Space Shuttle project. Oil-related construction workers reside primarily in the Lompoc Valley (SBCCAPC 1987b).

Employment provided by local Lompoc Valley industries is concentrated in government, manufacturing, and services. This concentration demonstrates the importance of VAFB to the local economy, since the base provides about two-thirds of local job opportunities. Other off-base employment opportunities are comprised of manufacturing (other than aerospace), agriculture, and community retail trade, services, and construction.

As the major service center for the North County region, the city of Santa Maria and the unincorporated communities of the Santa Maria Valley have a broad employment base. Major employment includes agriculture, oil and gas, and manufacturing, including a number of high technology industries related to VAFB. Retail trade and service businesses provide many of the goods and services to residents of north Santa Barbara County and south San Luis Obispo County. Local employment is strongly influenced by VAFB activities, since these retail and service establishments depend in part on the expenditures of military and civilian VAFB personnel and their families.

3.12.1.2 Regional Economics of VAFB

In Fiscal Year 1987, total expenditures for operations at VAFB amounted to $337 million (USAF 1988b). These expenditures included approximately $305 million for military, civilian, and contract labor payroll, $20 million for construction, and $10 million for services and other materials and supplies. Of this total, $182.4 million were estimated to have been expended in the Santa Barbara County/San Luis Obispo County economic impact region as identified by the USAF. Service contracts primarily went to local communities, including approximately $4 million in Lompoc, $2 million in Santa Maria, and an additional $2 million in other communities of Santa Barbara and San Luis Obispo counties.

3.12.1.3 Population

The estimated 345,000 residents of Santa Barbara County are primarily concentrated along the coast, in communities along U.S. 101 and Highway 1. The city of Santa Barbara (pop. 79,000) in the South Coast region is the area's largest incorporated community. Santa Maria (pop. 53,000) and Lompoc (pop. 32,300) are the principal communities of north Santa Barbara County (California Department of Finance 1988).

Overall, the population of Santa Barbara County increased at an approximate two percent average annual rate from 1980 to 1988. According to the latest available data, the North County area increased by 20 percent between 1980 and 1985, while the South Coast increased by about five percent (see Table 3.12.2, Santa Barbara County Population 1960-1988). Factors in the more rapid growth of the North County through 1985 include increased activity at VAFB associated with the construction of Space Shuttle facilities and MX missile testing, growth of the tourist industry, and the influx of population from the South Coast in response to that area's housing construction limitations and increased housing costs.

Although total employment at VAFB has decreased from approximately 16,000 to 11,000 since 1985, North County population growth has continued, largely associated with development of offshore oil and gas resources. In 1987, the population impact attributed to oil and gas industry activities in Santa Barbara County was nearly 2,700, largely a result of construction-related employment (CSBRMD 1988). More than 80 percent of this oil-related growth is believed to have occurred in North County communities, including an estimated 1,600 persons in Lompoc.

Population growth in Lompoc Valley and the city of Lompoc historically has been closely associated with VAFB activities (SBCCAPC 1985). However, despite the increased activity at VAFB in the early 1980s, the population of Lompoc Valley grew at a slower rate than the remainder of the North County. The slower growth rate was partly attributable to a reduction in military population at VAFB as a greater reliance was placed on civilian contractors for VAFB activities. Also, the location of a number of VAFB-related businesses in Santa Maria, and that community's increasing role as North County service center, may have enabled the Santa Maria Valley rather than the Lompoc area to attract a larger share of VAFB-related growth than during previous years.

TABLE 3.12.2

SANTA BARBARA COUNTY POPULATION
1960-1988

LOCATION	POPULATION					PERCENT CHANGE 1970-80	PERCENT CHANGE 1980-85	PERCENT CHANGE 1980-88
	1960	1970	1980	1985	1988			
South Coast								
• City of Santa Barbara	58,768	70,215	74,414	77,315	78,957	6.0	3.9	6.1
• Other	34,487	80,210	96,439	101,900	N/A	20.2	5.7	N/A
Total	93,255	150,425	170,853	179,215	N/A(1)	13.6	4.9	N/A
North County								
• Cuyama	1,344	1,212	1,180	1,228	N/A	-2.6	4.1	N/A
• Santa Ynez Valley	6,462	8,328	14,097	18,240	N/A	69.3	29.4	N/A
• Santa Maria Valley								
- City of Santa Maria	20,027	32,749	39,685	48,837	52,955	21.2	23.1	33.4
- Unincorporated	15,450	20,023	23,775	30,432	N/A	18.7	28.0	N/A
• Guadalupe	4,190	3,858	4,322	5,043	5,433	12.0	16.7	25.7
• Lompoc Valley						3.9	14.8	23.1
- City of Lompoc	14,420	25,284	26,267	30,158	32,333			
- Vandenberg AFB	N/A	13,193	8,136	7,752(3)	N/A	-38.3	-6.7	N/A
- Unincorporated(2)	13,814	22,445	18,512	20,713	N/A	-17.5	11.9	N/A
Total	75,707	113,899	127,838	153,505	N/A	12.2	20.1	N/A
Total Santa Barbara County	168,962	264,324	298,694	332,720	345,003	13.0	11.4	15.5

Note: (1) N/A - Not available
(2) Includes VAFB population.
(3) Fiscal Year 1987 population.

Sources: U.S. Bureau of the Census, 1962, 1972, and 1982.
Santa Barbara County Cities Area Planning Council 1985.
California Department of Finance 1988.

Recent population growth in the I ompoc Valley is also attributed to an increasing number of persons choosing to commute to jobs in the South Coast (SBCCAPC 1987b). Since 1970, housing costs in the South Coast have increased more than in North County communities. The less expensive housing in Lompoc Valley has increasingly attracted home buyers from the South Coast (SBCCAPC 1985). Also, high housing costs in areas that have traditionally drawn retirees, including the South Coast, Santa Ynez Valley, and coastal San Luis Obispo County, have helped to redirect some of this demand to both the Lompoc and Santa Maria Valleys.

3.12.1.4 Housing

The estimated number of housing units within Santa Barbara County is approximately 131,000, an increase of about 20 percent from the 1980 level of approximately 109,000 (Santa Barbara County 1985), as indicated in Table 3.12.3 (Selected Population and Housing Estimates, Santa Barbara County 1988). The number of housing units has increased more rapidly in North County than the South Coast as a result of population growth generated by increased employment and economic activity and South Coast housing restraints, particularly building moratoria and high costs. Housing vacancy rates currently range between two and five percent, with the higher rates generally being in North County. The Lompoc vacancy rate is about five percent, compared to the county rate of about four percent.

In 1987, Santa Barbara County had approximately 8,500 temporary housing units, such as hotel and motel rooms (SBCCAPC 1988). Overall hotel/motel occupancy rates were expected to decrease from 75 percent in 1986 to 63 percent in 1987 as a result of new hotel construction (USAF 1987a), with peak occupancy rates between 90 and 100 percent. The higher rates are in tourist-oriented communities such as Solvang (SBCCAPC 1985).

3.12.1.5 Public Facilities and Services

Water usage in many areas of Santa Barbara County exceeds the safe yield capacity of water sources. At present, 75 to 80 percent of the county water supply is derived from ground water resources (USAF 1987a, 1987b), and the rest is from surface reservoirs, primarily along the Santa Ynez and Santa Maria Rivers. Present county-wide water deficits are approximately 40,000 acre-feet per year, with constraints being most severe in the South Coast, where several

TABLE 3.12 3

SELECTED POPULATION AND HOUSING ESTIMATES SANTA BARBARA COUNTY 1988

COMMUNITY	TOTAL POPULATION	TOTAL HOUSING (NO. UNITS)	TOTAL HOUSING 1980 (NO. UNITS)	SINGLE FAMILY (NO. UNITS)	MULTI-FAMILY (NO. UNITS)	MOBILE HOMES (NO. UNITS)	OCCUPIED HOUSING (NO. UNITS)	PERCENT VACANT	AVERAGE HOUSEHOLD SIZE (Persons/Unit)
Santa Barbara	78,957	35,775	32,509	17,945	17,522	308	34,141	4.6	2.3
Carpinteria	13,067	5,366	3,989	2,530	2,042	794	4,902	8.7	2.7
Santa Maria	52,955	19,413	14,040	12,049	6,171	1,193	18,663	3.9	2.8
Lompoc	32,333	12,292	5,523	7,163	4,331	798	11,649	5.3	2.6
Guadalupe	5,433	1,396	951	1,046	346	4	1,368	2.0	4.0
Solvang	4,133	1,950	1,347	1,185	599	166	1,769	9.3	2.3
Total Incorporated	186,878	76,192	58,359	41,918	31,011	3,263	72,492	4.8	2.5
Total Unincorporated	158,125	55,144	50,957	37,982	13,665	3,497	53,355	3.3	2.8
Total County	345,003	131,336	109,316	79,900	44,676	6,760	125,847	4.2	2.6

Source: California Department of Finance 1988.

districts (Montecito, Summerland, and Goleta) have restricted water meter hookups (SBCCAPC 1985). This situation has contributed to curtailment of housing construction in South Coast communities.

North County districts are also in overdraft, largely as a result of agricultural use (SBCCAPC 1985). Water resources have not been identified as a constraint to future urban development in the North County (SBCCAPC 1985), as the water needs of new development are expected to be met from existing sources currently used by local agriculture operations.

Sufficient wastewater treatment capacity exists in the North County communities of Santa Maria, Lompoc, and Guadalupe to accommodate demand through the year 2000 (USAF 1987a).

Police and fire protection services in the Lompoc-Santa Maria area are provided by both municipal and county agencies. These agencies include the municipal departments in Lompoc, Santa Maria and Guadalupe, and the Santa Barbara Sheriff's and Fire departments. Fire protection services include mutual-aid agreements among these agencies.

Population growth in the North County has resulted in the addition of new students to area schools. At present, the Santa Maria Elementary and Guadalupe Union Elementary school districts are both at capacity (USAF 1987a). The Orcutt Elementary, Lompoc Unified, and Santa Maria Joint Union High School Districts have capacity for additional students. The Lompoc Unified School District receives most of the VAFB-related school age population.

The VAFB region is supplied with electrical power from Pacific Gas and Electric Company (PG&E). This power is supplied from an interconnected system that receives input from over one hundred power plants located throughout the western United States. This system extends from Southern California north to British Columbia, and east to include Idaho, Utah, and Arizona. Parts of the system also extend south, into Mexico. Peak demand on this grid has reached 18,000 MVA (megavolt-ampere), but usually averages about 15,000 MVA for an average day. Power plants used to produce electricity for the grid are powered by various sources, such as fossil and nuclear fuels, geothermal and solar energy, and co-generation.

3.12.2 LOCAL ENVIRONMENT

3.12.2.1 Employment

VAFB remains the major economic influence in northern Santa Barbara County and the Lompoc Valley (USAF 1987b). Approximately 40 percent of the Lompoc Valley and nine percent of the Santa Maria Valley labor forces are employees at VAFB. Overall, about 20 percent of the North County labor force and seven percent of the labor force in Santa Barbara County are employed at VAFB.

In 1987 the estimated direct and indirect employment related to VAFB in Santa Barbara and San Luis Obispo Counties was approximately 15,400 (VAFB 19873e). This included 11,100 jobs on-base, as well as 4,300 jobs in the general community, the latter attributed to the expenditures of both VAFB employees and VAFB agencies. In addition, since much of the hardware needed for military and aerospace operations at VAFB comes from outside the Lompoc-Santa Maria area, some expenditures occur outside the local area (USAF 1987b). In 1987, an additional 5,100 jobs outside of Santa Barbara and San Luis Obispo Counties were attributable to VAFB-related expenditures (USAF 1987b).

The 1987 VAFB employment of 11,239 was a 30 percent decrease from the 1985 employment of 16,010 (USAF 1987e). Most of the decrease was due to an approximate 45 percent decline in the number of aerospace contract employees. As demonstrated in Table 3.12.4 (VAFB Military and Contract Work Force 1960-1987), the recent employment changes continue the more than 25-year cycle of fluctuating activity at VAFB. Changing employment conditions are attributable to the ongoing pattern of initiation and completion of various programs. Recent contributors to the changing conditions include the Space Shuttle facilities which have been placed in "mothball" status, with launches indefinitely postponed, and the current MX testing program scheduled for completion in 1989.

3.12.2.2 Population

The resident population of VAFB is currently about 7,750 military personnel and dependents (USAF 1987e). Over 80 percent of the military personnel stationed at the base live on-base; the remaining 20 percent live primarily in the local Lompoc-Santa Maria area. VAFB military population has remained relatively stable in recent years after a period of decline between the late 1960s and the late 1970s (see Table 3.12.4).

TABLE 3.12.4

VAFB MILITARY AND CONTRACT WORK FORCE 1960-1987

YEAR	MILITARY/ CIVIL SERVICE	CONTRACTORS	TOTAL
1960	7,871	7,690	15,561
1961	9,478	9,083	18,561
1962	11,148	10,912	22,060
1963	10,597	10,427	21,024
1964	11,859	6,105	17,964
1965	11,578	7,869	19,447
1966	11,501	7,425	18,926
1967	11,493	7,887	19,380
1968	10,444	6,153	16,597
1969	9,854	5,976	15,830
1970	9,098	5,147	14,245
1971	8,359	4,793	13,152
1972	7,862	4,454	12,316
1973	7,396	4,458	11,854
1974	6,900	4,182	11,082
1975	6,994	3,335	10,329
1976	6,549	3,451	10,000
1977	6,307	3,605	9,912
1978	5,380	3,936	10,316
1979	5,922	4,243	10,165
1980	5,941	4,695	10,636
1981	6,272	6,264	12,536
1982	6,463	6,916	13,379
1983	6,857	7,042	13,899
1984	6,463	8,428	14,891
1985	6,724	9,286	16,010
1986	6,657	7,424	14,081
1987	6,247	4,992	11,239

Sources: USAF 1987a, 1987e.

3.12.2.3 Housing

Permanent and temporary military housing are provided at VAFB. At present, the base has 2,078 accompanied (family) housing units, including 1,800 single-family units. The remainder consists of duplex and multi-family units (USAF 1988g). The base also has about 170 permanent mobile home spaces and unaccompanied (dormitory) housing for about 1,600 airmen and 300 officers. There are about 20 guest housing units. VAFB housing is available to USAF and other military personnel in the area. Currently, vacancy rates are approximately ten percent for housing units (USAF 1988e) and 40 percent for dormitory units.

3.12.2.4 Public Facilities and Utilities

VAFB provides most of its own services and utilities. In 1986, VAFB supplied about 90 percent of its own water, purchasing the remainder from the adjoining Park Water Company. VAFB conveys wastewater from its administrative/industrial area to the Lompoc POTW. Individual package treatment facilities serve the more remote support areas for VAFB launch facilities. On-base police and fire service needs are provided by the USAF, and there are cooperative/mutual aid agreements with adjoining local departments.

Two elementary schools are located at VAFB and operated by the Lompoc Unified School District. High school students attend school off-base. About 20 percent of the enrollment of the Lompoc School District is comprised of children whose parents are employed and housed by the federal government.

Pacific Gas and Electric supplies commercial electrical power to VAFB from one substation near North VAFB. This substation fees two power loops, one each to North and South VAFB. Ten substations within VAFB provide electricity to facilities throughout the base. These substations are capable of supplying 92.5 MVA of electricity to VAFB. Current on-base electrical usage averages about 42 MVA, with peaks to approximately 52 MVA.

3.13 LAND USE

3.13.1 REGIONAL ENVIRONMENT

3.13.1.1 Regional Land Use

Land use in Santa Barbara County consists primarily of agriculture/grazing and other undeveloped uses, principally recreation. Urban use comprises about three percent of the total county area. Urban development in proximity to VAFB is predominantly to the north and east, with the city of Lompoc and the unincorporated communities of Vandenberg Village and Mission Hills to the east in the Lompoc Valley. Casmalia, Guadalupe, and Santa Maria-Orcutt are located north and east in the Santa Maria Valley (USAF 1988b), as shown in Figure 3.11.1.

Undeveloped and rural uses largely adjoin the north and east boundaries of VAFB. These areas are dominated by grazing and intensive agriculture, with some scattered oil production activities. To the west, offshore uses are mostly oil production, commercial fishing, marine recreation, and marine transportation. The VAFB shoreline also includes three public beach parks, one each immediately north and south of VAFB and one at the boundary of North and South VAFB.

3.13.1.2 Regional Land Use Plans

County and city comprehensive plans and zoning regulations determine the future development of lands within their respective jurisdictions. The county of Santa Barbara and the cities of Lompoc, Santa Maria, and Guadalupe are the local planning authorities for both incorporated and unincorporated areas adjoining VAFB. At present, the city of Lompoc has land zoned for residential uses that could support an additional 2,500 housing units. In addition, vacant land in the surrounding unincorporated areas is residentially zoned for about 2,300 units (SBCCAPC 1987a). Under current regulations, the development potential of the city of Santa Maria and adjacent unincorporated areas is about 5,000 and 10,000 units, respectively.

Santa Barbara County land use plans designate much of the area adjoining VAFB as agricultural. These designations are applied to the productive agricultural soils of Lompoc and Santa Maria Valleys. Other non-urban land east of the base is designated for rural residential use.

Plans are being developed for a potential residential community on the Bixby Ranch (pers. comm., Bixby Ranch representatives, 1988). Planning and some development have been completed for the Hollister Ranch property, also south of VAFB, adjacent to the east of the Bixby Ranch (see Figure 3.13.1, Coastal Zone, North Coast Planning Area). The Bixby and Hollister properties both are within the coastal zone of Santa Barbara County and, therefore, governed by the county Coastal Plan rather than the General Plan and Zoning Regulations. The Coastal Plan seeks to maintain non-prime agricultural operations (e.g., grazing) in the coastal areas of North County through large-lot zoning. Both ranch properties are currently zoned Agriculture-II (A-II), with minimum lot sizes of 100 acres on the Hollister property, which is presently being developed.

3.13.2 LOCAL ENVIRONMENT

3.13.2.1 VAFB Land Use

VAFB encompasses an area of 98,400 acres, representing approximately six percent of the total land area of Santa Barbara County (USAF 1988g). VAFB land use can be divided into eight categories, as shown in Figure 3.13.2 (VAFB Land Use). As shown, the greatest use of land (60 percent) is for open space and recreation. The next greatest use (37 percent) is for agriculture, primarily grazing. Most of the project area is within existing grazing allotments.

The base is bisected by the Santa Ynez River and State Route 246 into North and South VAFB. Most development is on North VAFB, primarily within the administrative/industrial area, which contains the VAFB residential, support, and most administrative facilities. Remaining North VAFB development includes an airfield, plus test facilities and SLC-2 for a number of operations, including MX and Minuteman, ICBM, and Delta space launch vehicles (USAF 1983).

South VAFB is largely undeveloped, with 99 percent of its land in open space. The other one percent contains four space launch complexes, several mountaintop tracking stations, and a 150-acre administrative/industrial area. Launch facilities for the Atlas (SLC-3), Titan II and IV/NUS (SLC-4 East and SLC-4 West), Scout (SLC-5), and Space Shuttle (SLC-6) are located at South VAFB. The administrative/industrial area includes NASA offices, radio transmitting facilities, warehouses, a gas station, and a fire station. Some of the undeveloped portion of South VAFB is leased for grazing (USAF 1983). With the exception of SLC-6, the proposed study area is located in an undeveloped portion of South VAFB, near the southern terminus of Coast Road.

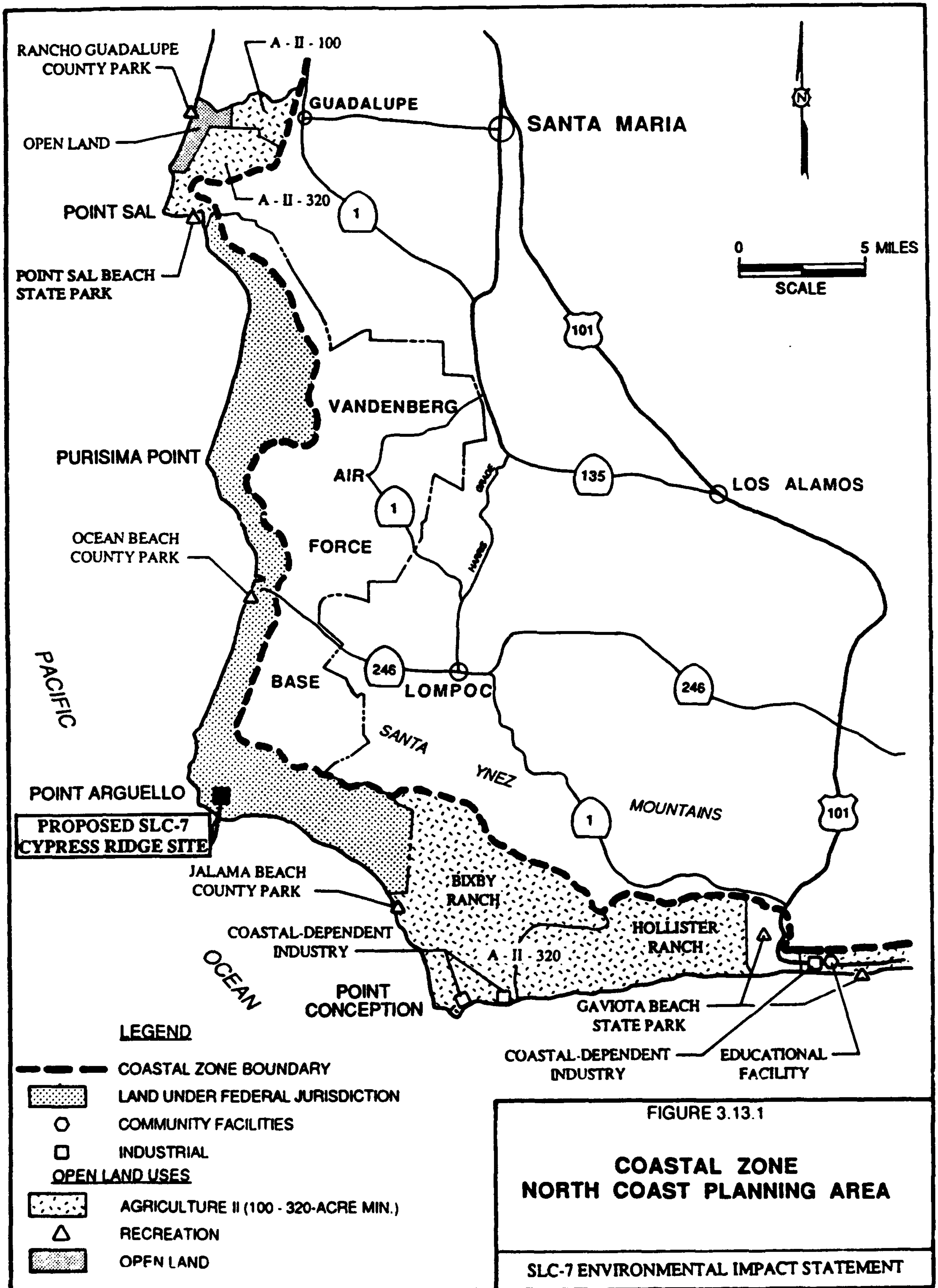
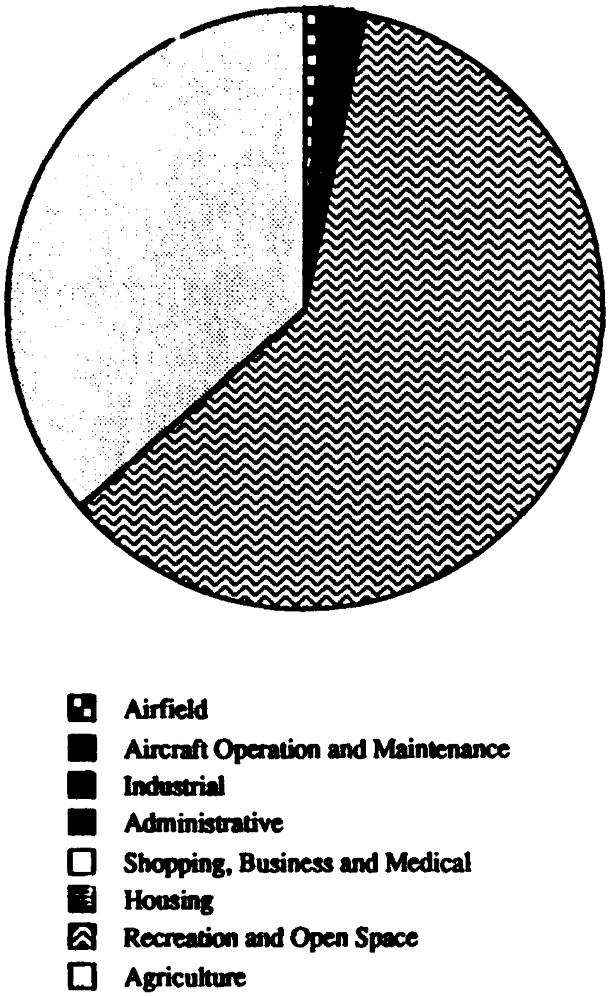


FIGURE 3.13.1

COASTAL ZONE NORTH COAST PLANNING AREA

SLC-7 ENVIRONMENTAL IMPACT STATEMENT

REVISED 3/14/88



TYPE OF USE	NUMBER OF ACRES	PERCENT OF TOTAL
Airfield[1]	860	0.8
Aircraft Operation and Maintenance[2]	520	0.5
Industrial	730	0.7
Administrative	310	0.3
Shopping, Business, and Medical	180	0.1
Housing	620	0.6
Recreation and Open Space	59,180	60.0
Agriculture - Grazing 35,000 - Crops 1,000	36,000	37.0
TOTAL AREA	**98,400**	**100.0**

(1) Runways, aprons, and safety clearance zones.
(2) Airport facilities, missile launch pads, and SLCs.

Source: USAF 1988g.

FIGURE 3.13.2

VAFB LAND USE

SLC-7 ENVIRONMENTAL IMPACT STATEMENT

The Cypress Ridge, Boathouse Flats, and Vina Terrace sites are within the area leased for grazing. The Southern Pacific Railroad traverses the base in a north-south direction from a point west of Casmalia. Through South VAFB, the railroad generally is adjacent to the coastline.

3.13.2.2 VAFB Comprehensive Plan

A new comprehensive plan for VAFB is being developed in order to enhance operations. With respect to space and missile operations, the draft plan identifies the following objectives:

- Mission Accomplishment - To continue to perform the missions of the Strategic Air Command and Air Force Systems Command.
- Flexibility and Expansion - To incorporate flexibility that will permit adaptation to changes in technology and reserve land to allow for proposed or unforeseen future needs.
- Safety - To continue to perform the space and missile operations in a safe manner to protect the welfare of the base and the surrounding communities.
- Environmental Quality - To continue to minimize the detrimental effects to the natural environment of VAFB.
- Public Needs - To continue to work with public interests in the area without jeopardizing the necessary base operations.

The draft plan identifies constraints that could limit, or be limited by, future launch facility siting and operations. Of particular concern relative to launch operations are range encroachments. These include incompatible land uses on adjoining property, onshore and offshore oil production and support facilities, airspace, railroad and electrical substations, and public access to coastal beaches (USAF 1988b).

3.13.2.3 Coastal Zone Management

California Coastal Zone Management regulations emerged from passage of the California Coastal Zone Conservation Act of 1972. Passage of this act led to the formation of the California Coastal Zone Conservation Commission and six regional coastal commissions, which subsequently prepared a state-wide comprehensive coastal zone plan. In 1976, the California Coastal Act became the basis of the California Coastal Zone Management Program.

The heart of the Coastal Zone Act is found in Chapter 3, the Coastal Resources Planning and Management Policies. A Local Coastal Plan (LCP) is required of each of the 53 cities and 15 counties along the California coast, with approval by the state and regional coastal commissions. These LCPs must conform to state standards and address issues such as beach access, recreation, marine environment, areas of environmentally sensitive habitat, agriculture, visual resources, and coastal-dependent energy and industrial development. The California Coastal Commission has permit jurisdiction and amendment approval for the individual LCPs (CSBRMD 1982).

Federal lands are the only areas along the California coast not covered by this act. However, the Federal Coastal Zone Management Act of 1972 states that activities in California affecting the Coastal Zone must comply to the "maximum extent practicable" with the California Coastal Act. This requirement is implemented through a "Coastal Consistency Determination" (USAF 1983). In certain circumstances, projects located on federal land create impacts that "spill over" onto the state coastal zone. In such a situation, a Coastal Consistency Determination is prepared for the proposed project and submitted to the California Coastal Commission for review. Since the proposed SLC-7 project has potential "spill over" impacts, the California Coastal Commission is a reviewing agency for the proposed project. A Coastal Consistency Determination has been prepared and submitted to the California Coastal Commission.

The Santa Barbara County coastline is divided into seven subareas. The subarea along the western boundary of VAFB is the North Coast Planning Area, which extends north from Gaviota to the mouth of the Santa Maria River, which forms the boundary between Santa Barbara and San Luis Obispo County, about 10 miles north of the VAFB boundary. Not included in this area is the VAFB Coastal Zone, which is regulated by federal law. Figure 3.13.1 shows the North Coast Planning Area in relation to VAFB and the land use designated for that area (CSBRMD 1982).

3.14 RECREATION

3.14.1 REGIONAL ENVIRONMENT

Public recreation opportunities in the vicinity of VAFB are available at five local parks operated by the Santa Barbara County Parks Department and the state of California: (1) Rancho Guadalupe County Park, (2) Point Sal Beach State Park (North Beach), (3) Ocean Beach County Park, (4) Jalama Beach County Park, and (5) Gaviota Beach State Park (see Figure 3.13.1). The one within the potential impact area is Jalama Beach County Park.

Ocean Beach County Park (Surf) is located between North VAFB and South VAFB at the western terminus of State Highway 246. The park offers amenities for picnicking and is open for day use only. Based upon a Santa Barbara County Park Department estimate of 125 cars per week (Hobbs 1988), about 32,000 people visit Ocean Beach Park annually.* Ocean Beach County Park is rarely closed for space launches, and it does not lie in the path of launches from South VAFB.

Jalama Beach County Park is located at the southern limit of South VAFB and is reached via Jalama Road from State Highway 1. Amenities are provided for day use picnicking, and there are approximately 100 sites for overnight camping. The Santa Barbara County Parks Department (1988) estimates that annual attendance at Jalama Beach is approximately 255,000 to 315,000.

Jalama Beach County Park is closed to public access for low-azimuth Titan launches. In accordance with 1STRAD regulations for Safety Control Areas, the Santa Barbara County Parks Department, County Sheriff, and California Highway Patrol are notified of a scheduled launch event. The park ranger posts a notice indicating time and date of park closure. The County Sheriff usually initiates procedures for barricade about six hours prior to launch, and the park ranger clears the area. Following the launch or launch cancellation, the USAF informs the park ranger and sheriff, and the park is reopened.

South VAFB launches affecting possible closure of Jalama Beach occur from SLC-3 (Atlas) and SLC-4 (Titan II, Titan 34D, and Titan IV). Annual launches from these SLCs are variable, depending upon availability and mission requirements. In 1987, five launches were planned.

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*Based upon standard rate of 2.7 persons per vehicle.

Four occurred, resulting in three closures of Jalama Beach County Park. Planned launches that could result in potential closure of Jalama Beach County Park include seven in 1989 and three in 1990.

3.14.2 LOCAL ENVIRONMENT

Limited public access to the VAFB shoreline is provided from the ocean and from three contiguous public beach areas. Public access to the California shoreline is permissible up to the mean high tide line. Access to the North VAFB shoreline is available from Point Sal Beach State Park (North Beach) and Ocean Beach County Park (Surf). Access to the South VAFB shoreline is available from Surf and Jalama Beach County Park. There also is access from the open ocean throughout the length of VAFB.

The primary recreation facility at South VAFB is the area around the former U.S. Coast Guard Rescue Station, or Boathouse. The Boathouse area is available to USAF personnel and their guests for picnicking, diving, swimming, and fishing. The period of greatest use is during abalone season. About 400 persons used the area during 1987.

4.0 ENVIRONMENTAL CONSEQUENCES AND MITIGATION MEASURES

This analysis of potential impacts is an evaluation of changes that are likely to result from implementation of the proposed SLC-7 project at the Cypress Ridge site or one of its alternatives. The effects are evaluated relative to both the regional and local environments, as defined in Section 3.0. In this chapter, impacts are first discussed for the proposed Cypress Ridge site, then for the SLC-6, Boathouse Flats, and Vina Terrace alternatives. Where impacts are the same for more than one of the potential sites, the appropriate discussion is referenced, but the information is not repeated. The analyses utilize existing data from USAF, the county of Santa Barbara, and other public and private sources. Anticipated direct and indirect impacts are assessed quantitatively and/or qualitatively, with consideration to both short-term (project construction period) and long-term (project operations period) effects. Potential cumulative impacts also are addressed, as are mitigation measures.

For some analyses, notably vegetation, wildlife, and cultural resources, onsite studies were conducted to evaluate resources that could be affected by project implementation. Information derived from these studies also was utilized in the analyses of geology/soils, visual resources, land use, and water resources. In general, it was found that most potential direct or indirect impacts could be avoided through project design or operational procedures, or mitigated to levels of insignificance. The criteria for impacts to be considered significant are discussed at the beginning of each section of this chapter.

4.1 GEOLOGY AND SOILS

This section addresses potential impacts and hazards related to geology and soils, within both the region and the South VAFB project area. Primary concerns relate to the potential occurrence of earthquakes, landslides, and erosion and the subsequent impact to project related facilities and/or personnel. Project activities evaluated in this section primarily are those related to construction, such as grading, cut/fill, and short- and long-term earth stabilization measures. The potential occurrence and impact of a major seismic event also is evaluated.

An impact is considered significant if it would result in one or more of the following:

- Exposure of people or structures to major geologic hazards.
- Occurrence of substantial erosion or siltation.
- Uncontrolled release of chemicals/fuels into the environment.

- Occurrence of substantial landsliding.
- Substantial damage to project structures/facilities.

4.1.1 REGIONAL IMPACTS

Regional impacts relative to geology and soils are not anticipated. Potential local impacts are discussed below.

4.1.2 LOCAL IMPACTS

Local impacts could occur as a result of construction and operation of the proposed launch complex. Major concerns are the potential effects of landslides and erosion, primarily related to cut and fill activities during project construction, and earthquakes during project operations. For the proposed action, final quantities of cut and fill would depend on design requirements, local soil characteristics, and suitability of the cut material for use as fill. As proposed, implementation of the proposed action at the Cypress Ridge site would require about 1.5 million cubic yards (CY) each of cut and fill. The SLC-6 alternative would require neither cut nor fill, thereby avoiding associated impacts. The Boathouse Flats alternative site would require about 0.6 million CY of cut and 0.4 million CY of fill, and the Vina Terrace site would involve about 10 million CY of cut and no fill.

Operational impacts would result from deposition of acidic and metallic compounds during a launch. Over time, the acidic compounds could accumulate, thereby reducing the overall buffering capacity of the soil. However, this would not be significant, due to the low rate of a maximum three launches per year (NASA 1987). Concentrations of metallic compounds in the soil also would be expected to increase slightly with time, but not significantly, due to the low launch rate and low concentrations of these substances in the ground cloud. In addition, natural processes of erosion and leaching would, to some extent, alleviate buildup of acidic and metallic compounds.

4.1.2.1 Cypress Ridge

Landsliding

Structures and other project components (including utility corridors) near the toe of existing slopes could be potentially impacted by natural or induced landslides resulting from slope instability. The landslide mass for slides originating above planned project facilities could damage proposed

buildings, tanks, or utilities. Landslides or slope failures below planned facilities could result in potential adverse undermining or subsidence of facilities lying above the potential slide plane.

Aerial photographs show no indication of slope failures in the Cypress Ridge area within the last several hundred years. Therefore, significant impacts due to natural occurrences are not expected. Grading activities for the proposed facilities at Cypress Ridge would result in significant cut slopes. During construction and operation, failure of the cut sections could result in potential significant impacts to adjacent facilities and structures. However, as part of preliminary site investigations and design for the proposed Cypress Ridge site, the U.S. Army Corps of Engineers is undertaking various geotechnical explorations in the area. These investigations are being conducted in a manner that will not limit the choice of reasonable alternatives or have an adverse environmental impact. Geotechnical information would be utilized in the facility design and grading plan such that significant impacts from landslides are not expected.

Erosion

The potential for erosion of soils identified at the proposed site ranges from severe for the loamy sands and shaley loams to moderate for the sandy and shaley sandy loams (see Table 3.1.1). Excessive erosion on surfaces could affect structures by undermining, resulting in foundation failures, and also cause undermining or failure of man-made or natural slopes. Eroded debris could accumulate in drainages and create silting and ponding of rain runoff. The potential for surface runoff and its erosion effects are discussed in Section 4.2, Water Resources.

Excessive erosion is not presently occurring within or adjacent to the site, based on evidence provided by examination of aerial photographs and site reconnaissance. However, erosion could be initiated if slopes were denuded by clearing and grading during the construction phase. Sandy, loose (friable) soils found within the site are generally more susceptible to erosion than are fine grained deposits. Gully erosion can be initiated by increased subsurface flow as a result of high infiltration rates due to a loss of vegetative cover. Unprotected steep slopes or shallow gradient surface underlain by soils susceptible to erosion are vulnerable. Excessive erosion has occurred within South VAFB at locations with inadequate protection for disturbed soil surfaces.

Erosion of natural and man-made slopes could result in significant impacts to nearby sensitive wetlands, as well as potential impacts to buildings and other facilities. These impacts could occur over the anticipated four-year construction period or after the facilities have become operational. Initial grading activities proposed for the site are early in the construction phase, and exposed soil

would require protection from rain water infiltration and runoff until final paving, buildings, and revegetation had been completed. If control measures were not implemented, soil losses during construction could reach 4,080 tons/year, a significant increase over the existing estimated 60 ton-per-year rate of soil loss. This could be a significant localized short-term impact (see Table 4.1.1, Estimated Surface Water Runoff and Soil Losses, Construction Phase).

Post-construction impacts associated with erosion of natural and man-made slopes would likewise be substantially controlled or eliminated with erosion control and by revegetation so that storm water runoff, deluge water, and washdown water would not contribute to erosion potential. After construction, soil loss would be about 48 tons/year, as shown in Table 4.1.2 (Estimated Surface Water Runoff and Soil Losses, Post-construction Phase). This is less than the existing rate of 60 tons-per-year at the undeveloped site, so it is not considered to be significant.

Earthquakes

There are no known active or potentially active faults that, if projected, would trend toward or through the proposed project site. For this reason, the hazard of surface rupture is not likely. However, in the event of a major regional earthquake, ground motion would be experienced at the Cypress Ridge site.

In order to assess the potential of earthquake impacts on the proposed project, the degree of ground shaking at the particular site must be determined. Ground shaking is dependent on the strength or magnitude of the earthquake and the epicentral distance from the site. For this site, two earthquake magnitudes were used, the maximum credible and maximum probable events. The maximum credible magnitude is the largest possible earthquake on a particular fault based on the known tectonic framework (i.e., maximum historic earthquakes, fault length, and displacement parameters). The maximum probable magnitude is the event most likely to have a 100-year return period; this magnitude is considered more likely to occur.

An indication of the ground motion that the Cypress Ridge site might experience from the maximum credible or probable event is provided in Table 4.1.3 (Potential Ground Motion at Project Area), which shows the known capable (active or potentially active) faults within approximately 60 miles of VAFB. The levels of peak ground acceleration (PGA) were computed using the Campbells' (1981) deterministic attenuation equations. The PGA is a measure of the resultant ground wave originating from the earthquake epicenter. Only those known faults that could substantially impact project components are listed in Table 4.1.3.

TABLE 4.1.1

ESTIMATED SURFACE WATER RUNOFF AND SOIL LOSSES CONSTRUCTION PHASE

	ASSUMED DISCHARGE POINT	COMPUTED DISCHARGE[1] (cubic feet per second)		SOIL LOSSES[2]	
		25-YEAR STORM EVENT	100-YEAR STORM EVENT	INCHES/YEAR	TONS/YEAR
CYPRESS RIDGE SITE	A	350	540	0.21	4,080
SLC-6[3]	B	390	590	0.007	317
	C	550	810		
	D	720	1080		
BOATHOUSE FLATS SITE	E	690	990	0.04	750
	F	300	450		
	G	310	460		
VINA TERRACE SITE	E	690	990	0.23	5,750
	H	510	760		
	I	270	400		

(1) Assumptions used for surface water runoff calculations :

- The Rational Method was used to compute peak discharge from each drainage basin.
- The design point was established at the lowest elevation near the shoreline.
- The method used assumes rainfall to be uniformly distributed over the study area.
- The 25-year and 100-year rainfall intensities were determined using frequency curves from the California Department of Water Resources Jalama Beach Station.
- Time of storm duration is considered less than time of collection.
- The surface material exposed during construction was assumed to be silty sand with moderate infiltration rates.

(2) Assumptions used in making soil erosion calculations:

- The soil losses are based on annual rainfall.
- The calculations of the soil losses were based on the U.S. Department of Agriculture Handbook 537, Predicting Rainfall Erosion Losses, 1987.

(3) This does not represent a change from existing rates.

TABLE 4.1.2

ESTIMATED SURFACE WATER RUNOFF AND SOIL LOSSES POST-CONSTRUCTION PHASE

	ASSUMED DISCHARGE POINT	COMPUTED DISCHARGE[1] (cubic feet per second)		SOIL LOSSES[2]	
		25-YEAR STORM EVENT	100-YEAR STORM EVENT	INCHES/YEAR	TONS/YEAR
CYPRESS RIDGE SITE	A	490	750	0.002	48
SLC-6[3]	B	390	590	0.007	317
	C	550	810		
	D	720	1080		
BOATHOUSE FLATS SITE	E	690	990	0.0001	3
	F	430	660		
	G	310	460		
VINA TERRACE SITE	E	690	990	0.003	75
	H	650	960		
	I	270	400		

(1) Assumptions used for surface water runoff calculations :

- The Rational Method was used to compute peak discharge from each drainage basin.
- The design point was established at the lowest elevation near the shoreline.
- The method used assumes rainfall to be uniformly distributed over the study area.
- The 25-year and 100-year rainfall intensities were determined using frequency curves from the California Department of Water Resources Jalama Beach Station.
- Time of storm duration is considered less than time of collection.

(2) Assumptions used in making soil erosion calculations:

- The soil losses are based on annual rainfall.
- The calculations of the soil losses were based on the U.S. Department of Agriculture Handbook 537, Predicting Rainfall Erosion Losses, 1987.

(3) This does not represent a change from existing rates.

TABLE 4.1.3

POTENTIAL GROUND MOTION AT PROJECT AREA

FAULTS	DISTANCE FROM SLC-7 (MILES)	MCE[1]	MPE[2]	PGA[3] (MCE)	PGA[4] (MPE)
Hosgri	11	7.5	7.0	0.28	0.20
Santa Lucia Bank	29	7.5	7.1	0.13	0.10
Unnamed Faults - Santa Lucia Bank	34	7.5	7.0	0.12	0.08
Offshore Lompoc	12	6.5	6.3	0.14	0.11
Offshore Purisima	15	6.5	6.3	0.11	0.09
Point Conception	13	6.5	6.3	0.14	0.11
Molino	22	6.0	5.9	0.05	0.05
Santa Ynez, including South Branch	20	7.5	7.2	0.17	0.13
Pezzoni - Casmalia	23	6.8	6.5	0.10	0.07
Los Alamos - Baseline	25	7.0	6.5	0.10	0.07
Santa Maria, Foxen, Little Pine	28	7.4	7.0	0.13	0.09
Big Pine	51	7.25	6.9	0.06	0.05
San Andreas	64	8.25	8.25	0.12	0.12

(1) MCE - Maximum Credible Earthquake Magnitude
(2) MPE - Maximum Probable Earthquake Magnitude
(3) PGA (MCE) - Peak Horizontal Ground Acceleration (g), for the MCE
(4) PGA (MPE) - Peak Horizontal Ground Acceleration (g), for the MPE

The highest PGAs impacting the project could be produced by the Hosgri fault. If the Hosgri fault were to rupture at its closest approach to the site (11 miles) and produce a maximum credible earthquake of 7.5, a PGA of 0.28g is possible. Similarly, if a maximum probable event of 7.0 were to occur at the same location, a PGA of 0.20g is likely. A 7.5 event on the Richter Scale is equivalent to approximately an X event on the Modified Mercalli Scale. Such an event can result in impacts such as destruction of wood structures, masonry and foundations, cracked ground, landslides, and slopping of contained water. A 7.0 event is equivalent to a Modified Mercalli event of IX and can result in "considerable to great" damage, depending on the structure, some collapse and foundation shifting, ground cracks, and underground pipe breakage.

Based on geologic and topographic conditions of the Cypress Ridge site, strong ground motion could result in strong ground shaking, induced landsliding, subsidence, and lurching. These actions could result in impacts to project components, particularly structures such as buildings, tanks, and piping. Although earthquakes cannot be avoided, the severity of the impacts arising from an earthquake would be substantially reduced by allowing for earthquake stresses in the design phase of the project. Structures would be designed as specified in USAF Manual 88-3, Chapter 13, Seismic Design for Buildings, in order to decrease their susceptibility to seismic activity. Containment systems around propellant storage and handling areas and on the launch pad would be designed to contain spills from tanks or piping which might be damaged as a result of earthquake activity. Such possibility is addressed in Section 4.11.2.1 and discussed in detail in the Risk Assessment (Environmental Solutions 1989f).

4.1.2.2 SLC-6

Landsliding

The potential for landslides at the SLC-6 alternative site is very low since construction-related earth moving occurred prior to 1970, and slopes that were disturbed have been stable to date. No additional excavation activities are anticipated relative to the proposed action. As a consequence, no significant impacts are anticipated.

Erosion

An erosion control program conducted as part of site maintenance activities has stabilized most slopes so that erosion is minimized. Erosion is still evident, however, on a steep cut-bank located to the east of the MST. Since the SLC-6 site consists of a relatively flat portion bordered by a

moderately sloping terrain, it possesses an intermediate level of potential for erosion from operations. Implementation of the SLC-6 alternative would avoid the large construction-related impacts which would occur at one of the undeveloped sites.

Earthquakes

Potential impacts due to a maximum credible earthquake are similar to those that would occur at the Cypress Ridge site. The design and construction standards that would be utilized for modifications at this site would minimize impacts from such an event.

4.1.2.3 Boathouse Flats

Landsliding

The Boathouse Flats site is the flattest of the four sites being considered and, as such, has the least potential for landslide activity. The proximity of this site to the coastal bluff presents the primary potential for earth movement. The retreat of the sea cliff along the southern site boundary is ongoing due to wave undercutting. Project components (including utility corridors) that could be affected by this undermining process are structures located near the top of the cliff. Current project plans indicate that the southern site boundary is 100 to 250 feet from the edge of the existing 40-foot high sea cliff. Therefore, no impact is expected.

Erosion

The shaley loam prevalent at the Boathouse Flats site is not prone to excessive erosion. However, small areas on the southeast corner of the site contain sandy and shaley loams, soil types which are characteristic of soils having moderate to high erosion potential. Further, these soils are located adjacent to a coastal wetland.

Potential impacts to the wetlands would be avoided by locating most of the facilities and site disturbance (construction) activities north and west of the high-potential erosion areas. The realignment of the Space Shuttle External Tank Tow Route would impact a portion of the high-potential erosion area. Proper design, control of construction disturbance, use of erosion control measures, and a post-construction maintenance plan would substantially reduce or eliminate potential impacts. As shown in Tables 4.1.1 and 4.1.2, soil loss during and after construction is

estimated at 750 and three tons/year, respectively. Construction impacts would be locally significant in the short-term. Operational soil loss would be less than the existing rate and so is not considered to be significant.

Earthquakes

Potential impacts due to a maximum credible earthquake event are similar to those that could occur at Cypress Ridge and would be minimized by proper design considerations, as discussed for the proposed Cypress Ridge site.

4.1.2.4 Vina Terrace

Landsliding

This site has the same potential for landslide as the Cypress Ridge site. The access road would be constructed at a six percent grade, with greater cut and fill requirements than for either the Boathouse Flats or Cypress Ridge access roads. Potential impacts from landslides (slope instability) would be eliminated through proper design consideration, as discussed for Cypress Ridge.

Erosion

Due to the relief of the Vina Terrace site, the extent of earthwork required to create level areas and access corridors would be greater than for the proposed Cypress Ridge site or the SLC-6 or Boathouse Flats alternative. Therefore, erosion control would require more elaborate engineering design than at the other sites. Soil losses due to erosion during construction could become substantial, estimated at 5,750 tons/year, as shown in Table 4.1.1. Table 4.1.2 estimates post-construction soil losses at 75 tons/year compared to existing rate of 90 tons/year, reflecting erosion control measures that would be incorporated into the project design.

Earthquakes

The potential impacts due to earthquakes are comparable to those discussed for the proposed Cypress Ridge site.

4.1.3 CUMULATIVE IMPACTS

No cumulative impacts to either local or regional geology and soils are anticipated as a result of the proposed SLC-7 project.

4.1.4 MITIGATION MEASURES

4.1.4.1 Cypress Ridge

Landsliding

Certain design considerations would be incorporated into project planning, thereby minimizing mitigation requirements.

Geotechnical investigations performed at the proposed site and along access roads and utility corridors, with subsequent results incorporated into the facilities design and grading requirements, would minimize potential slope stability problems. Geotechnical investigations include detailed geologic mapping, subsurface investigations, and laboratory testing and analysis, with subsequent recommendation for the facility design criteria. Studies include seismic design parameters for structures, including buildings, tanks, towers, utilities, and slopes. Design considerations typically would include slope retaining wall and buttress fills, removal of potential slide mass, stabilization by lowering the slope ratio, and locating critical structures away from potential slide planes.

Mitigation measures include provision of a surface drainage plan for periods of construction and operation and reduction of runoff rates by encouraging vegetation.

Erosion

Potential erosion of soils from the site during construction and operation, resulting in undermining of structures and silt deposition on sensitive wetland habitats, would be avoided by proper design of slopes and a planned revegetation program. Measures such as temporary paving, construction of rain water runoff retention basins, controlled site drainage, and use of erosion control material, as necessary on unstable slopes, would be employed to reduce potential construction impacts. Similar measures would be undertaken with paving activities and building construction to eliminate

final construction impacts. Additionally, the top six inches of topsoil removed from the proposed site would be stockpiled for revegetation of unpaved or unprotected surfaces at completion of construction activities.

Plans for final facility design would include many of the recommendations employed for project construction. Therefore, operational impacts are not anticipated. An erosion control and restoration plan, including maintenance of side slopes and drainage courses, would be employed to prevent significant impacts. Such a plan would include measures such as settling basins, energy dissipators, and/or flow dividers to control surface runoff and contain deluge and washdown water.

Earthquakes

Earthquake ground shaking at project facilities cannot be avoided. However, structures such as propellant storage and handling, containment areas, retaining walls, and fill slopes would be designed as required to withstand the expected ground motions. Site-specific and structure-specific analyses would determine appropriate structural design parameters. In certain critical areas, design requirements would be more stringent than USAF standards. Adherence to these standards and requirements would minimize possible impacts caused by earthquakes and the need for mitigations.

4.1.4.2 SLC-6

Landsliding

No mitigations relative to landsliding are recommended for this site, since landsliding is not considered a potential impact.

Erosion

Mitigation measures which have been established in the past for the cut slope on the mobile service tower include storm water drainage and utilization of concrete as erosion control material on the southern one-third of the embankment. These mitigation measures would be augmented by revegetation and use of erosion control fabric until the new vegetation becomes established. Existing laydown areas would be revegetated after construction.

Earthquakes

No mitigations relative to earthquakes would be required for the SLC-6 site.

4.1.4.3 Boathouse Flats

Landsliding

No mitigations relative to landsliding are recommended for this site, as landsliding is not considered a potential impact.

Erosion

Mitigations relative to erosion generally would be the same as those proposed for the Cypress Ridge site. However, due to the proximity of the coast and the coastal bluff, additional management practices would be required. These typically would include provision for settling basins, energy dissipaters, and/or flow dividers. These and other options would be incorporated into the design effort.

Earthquakes

No mitigations relative to earthquakes would be required for the proposed action at the Boathouse Flats site.

4.1.4.4 Vina Terrace

Mitigations relative to landsliding, erosion, and earthquakes would be the same as those proposed above for the Cypress Ridge site.

4.2 WATER RESOURCES

This section addresses impacts to surface and ground water resources which could result from implementation of the proposed action at any one of the four potential sites. The assessment incorporates consideration of measures incorporated into project design for purposes of conservation and/or as a result of water pollution control regulations.

Project elements evaluated include direct requirements for water at the project site during the construction and operations phases of SLC-7. Also evaluated is the indirect water demand of the anticipated population which would move into the region to fulfill project needs for construction and operations personnel. In order to assess maximum probable construction impacts, the water and personnel requirements for one of the three undeveloped sites was assumed. Operational impacts would be comparable at all four potential sites.

An impact is considered to be significant if it would result in one or more of the following:

- Degradation of surface or ground water quality to the extent that existing use(s) could not continue.
- Substantial depletion of surface or ground water resources.
- Creation of or contribution to overdraft of a ground water resource.
- Interference with ground water recharge.
- Wasteful use of water.

4.2.1 REGIONAL IMPACTS

Surface Water

The surface water of the regional environment would not be affected either directly or indirectly by construction or operation of the proposed SLC-7 project.

Ground Water

Ground water in the regional environment would be indirectly impacted as a result of construction and operation of the proposed action due to additional population that comes into the area. An estimated 550 workers would be needed at the peak of construction at the undeveloped sites and would be expected to generate a total population increase of about 1,440 persons, which includes workers, their dependents, and new indirect employment in the local communities (see Table 4.12.1). Water usage in the region would be expected to increase by approximately 290 acre-feet

per year, assuming this worst-case scenario over the entire four-year construction period. For implementation of the proposed action at SLC-6, impacts to regional ground water resources would be significantly smaller due to a smaller labor requirement. It is assumed that the construction and modification at SLC-6 would require a peak labor demand of approximately 300, which would generate a regional population increase of approximately 790 persons. This increase would generate an additional demand of 158 acre feet of water per year.

The water use increase for operations would be about 305 acre-feet per year, based on a maximum of 400 personnel and a maximum regional population increase of about 1,470, which includes workers, dependents, and indirect employment. This increase in demand would be the same for the proposed Cypress Ridge and alternative sites. Of this increased demand for water during project operations, approximately 176 acre-feet per year would be in the Lompoc Valley and 116 acre-feet per year in the Santa Maria Valley. The remaining 13 acre-feet per year would be used elsewhere in Santa Barbara and San Luis Obispo Counties where employees would be expected to reside. The increase in water use would increase the total water used by the regional environment by less than 0.2 percent over existing levels. The ground water basins that presently supply water to the regional environment are experiencing an overdraft condition. The small increase in water usage during construction and operation of the proposed action would lead to a small overall increase in the overdraft condition of the aquifers and, therefore, would be significant.

4.2.2 LOCAL IMPACTS

4.2.2.1 South VAFB

Surface Water

No significant impacts to surface water on South VAFB in general are expected to result from construction or operations of the proposed SLC-7 project. Potential impacts and mitigation measures are discussed in Section 4.1, Geology and Soils.

Ground Water

The SLC-7 project would utilize the existing aquifer and water distribution system on South VAFB for potable water. The Lompoc Terrace ground water basin is not presently in overdraft. During the anticipated four-year construction period, the total estimated demand for water would be about 380 acre-feet per year, based on withdrawal rates recorded during modification of SLC-6 for the

Space Shuttle, assuming peak demand over the entire construction period. This demand would increase the withdrawal rate of the South VAFB water system by approximately 46 percent, similar to that shown for peak SLC-6 modification demand of 350 acre-feet. There were no significant impacts to ground water levels during that construction period. As shown in Figure 3.2.3, the 380 acre- .eet per year demand for SLC-7 would be for the short-term period of construction and would not be expected to significantly increase the depletion rate of the aquifer over the long term.

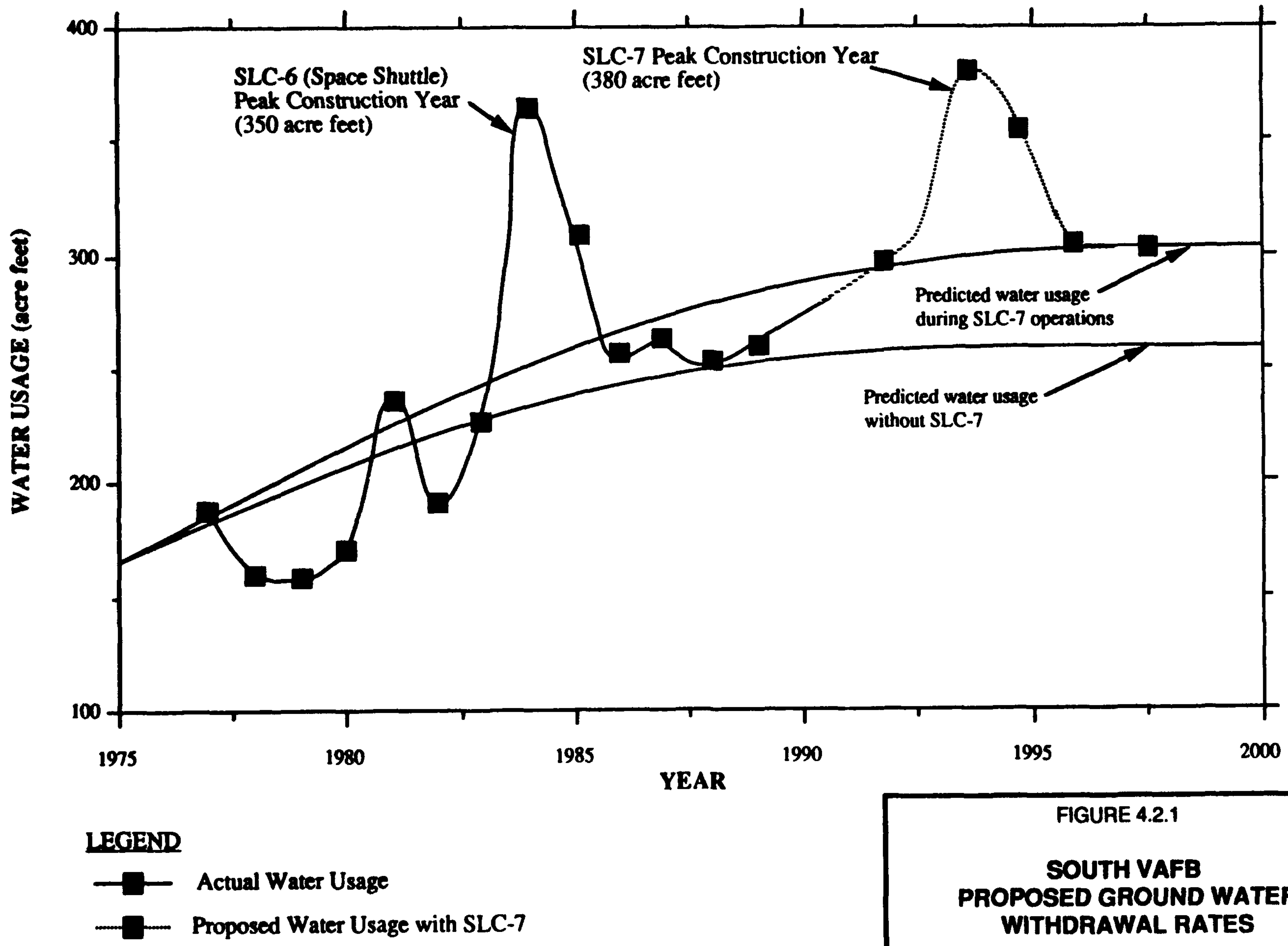
Water demand during SLC-7 operations would be about 45 acre-feet per year over current demand of the South VAFB water system of about 260 acre-feet per year. This additional amount would increase the demand for water by about 17 percent and is expected to put the ground water basin into overdraft by approximately 45 acre-feet per year. This impact, therefore, would be significant. The projected estimates for water usage are shown in Figure 4.2.1 (South VAFB Proposed Ground Water Withdrawal Rates).

4.2.2.2 Cypress Ridge

Surface Water

The majority of the Cypress Ridge site lies within the Oil Well Canyon watershed, as shown in Figure 3.3.2. Surface runoff on the site is limited to overland flow or small rills during or immediately following heavy rains. Over the long term, development of the site would be expected to decrease the infiltration rate and increase the surface water runoff that presently occur at the site. Estimates of surface water runoff during and after construction are shown in Tables 4.1.1 and 4.1.2. Runoff during construction is estimated at 350 cfs (cubic feet per second) for a 25-year storm event and 540 cfs for a 100-year event. Runoff after construction would be 490 and 750 cfs for 25-year and 100-year storm events, respectively.

Soil losses during and after construction are also shown in Tables 4.1.1 and 4.1.2. As shown, they would be considerably higher during construction, leading to increased turbidity and silting at the discharge points, shown in Figure 3.1.5. Soil losses from the site would be reduced after construction, with implementation of the revegetation program. Spills and precipitation at the launch complex would be contained within the complex boundaries and would not affect the surrounding area.



Source: USGS 1988.

FIGURE 4.2.1

SOUTH VAFB PROPOSED GROUND WATER WITHDRAWAL RATES

SLC-7 ENVIRONMENTAL IMPACT STATEMENT

Ground Water

No appreciable ground water supplies have been found under the site to date. The only existing ground water in the vicinity feeds springs located along Oil Well Canyon. Because water for the proposed SLC-7 project would come from the Lompoc Terrace ground water basin, impacts to local ground water and potential effects on the springs are not anticipated.

4.2.2.3 SLC-6

Surface Water

The SLC-6 site lies within the Red Roof Canyon watershed, as shown in Figure 3.3.2. Surface water runoff at the site would be most significant during heavy rains and lead to possible erosion and gully formation in Red Roof Canyon. Where necessary, revegetation and slope stabilization would be used to control erosion. Runoff and soil loss values for SLC-6 are shown in Table 4.1.1 and 4.1.2. Unlike the undeveloped sites, runoff and soil loss would be the same both during and after construction, as most of the fenced launch complex area is covered by impervious surfaces. Implementation of the SLC-6 alternative would mean that construction-related soil loss would not occur at one of the undeveloped sites.

Modification of the site for the Titan IV/Centaur would not impact either the infiltration rate or the surface runoff which presently occurs, and would not increase soil loss. To the contrary, soil losses related to erosion of the embankment which borders the site to the east may decrease as a result of the project-related revegetation program. Spills and precipitation at the launch complex would be contained within the site boundaries and would not affect the surrounding area.

Ground Water

Impacts to ground water would be the same as those identified for the proposed Cypress Ridge site.

4.2.2.4 Boathouse Flats

Surface Water

Development of the site would be expected to increase soil loss during construction more significantly than after construction. The increased soil loss during construction would be due to loss of vegetation and would be controlled after construction by revegetation. Tables 4.1.1 and 4.1.2 show estimated surface water runoff and soil loss values during and after construction. Figure 3.1.5 shows the discharge points for the runoff.

Increased turbidity and silting at the discharge points would be expected due to increased soil losses during construction, but would be reduced after construction due to revegetation.

Ground Water

Impacts to ground water would be the same as those identified for the proposed Cypress Ridge site.

4.2.2.5 Vina Terrace

Surface Water

Because of the incised terrain of the Vina Terrace site, runoff and soil losses during and after construction would be greater here than at the proposed Cypress Ridge or alternative SLC-6 or Boathouse Flats sites. Runoff and soil loss values for Vina Terrace are shown in Tables 4.1.1 and 4.1.2. As with the other two undeveloped sites, soil losses would be higher during construction than during operations. During operations, revegetation would reduce soil loss to less than existing conditions. Increased surface water runoff would be greatest during heavy rains and could lead to increased erosion and gully formation in the drainages around the site. Runoff would also be accelerated around the access roads and utility lines that would be built to the site.

During construction, increased surface water runoff and soil loss at the discharge points shown in Figure 3.1.5 would lead to increased turbidity and silting. After construction, turbidity and silting would be reduced by site reclamation and revegetation.

Ground Water

Impacts to ground water would be the same as those identified for the proposed Cypress Ridge site.

4.2.3 CUMULATIVE IMPACTS

4.2.3.1 Surface Water

Cumulative impacts caused by the construction and/or operation of the proposed project are not anticipated. Other developments are neither existing nor proposed within the drainage area of the three undeveloped sites. At the SLC-6 alternative site, no surface water impacts would occur, so there would be no contribution to potential cumulative impacts.

4.2.3.2 Ground Water

Regional Impacts

Cumulative impacts to the regional ground water basins would be related to the additional people who would move to the area to support the proposed project, plus other population increases projected to occur between 1990 and 1995 and over the duration of project operations. These impacts would be the same for the four potential sites since operations would be virtually the same.

Total 1995 water use in the Santa Maria and Lompoc Valleys is projected to be about 184,000 acre-feet per year, an increase of 22,000 acre-feet per year (14 percent) over 1988 levels. Of this 22,000 acre-feet, 15,000 would be drawn by the Santa Maria Valley and 7,000 by the Lompoc Valley. Implementation of the proposed project would increase water usage in the Santa Maria Valley by 116 acre-feet per year and in the Lompoc Valley by 176 acre-feet per year. The cumulative impact in water use for the Santa Maria Valley would be an additional, approximately 13 percent increase over projected 1988 levels. The Lompoc Valley would have an additional 14 percent increase over projected 1988 levels. The remaining 13 acre-feet per year of water that would be regionally required as a result of the SLC-7 project would be taken from other ground water basins in Santa Barbara and San Luis Obispo Counties. The cumulative impact of the additional 13 acre-feet per year is not expected to be significant. However, although regional project-related requirements would be relatively small, the cumulative impacts to the ground water basins in the Lompoc and Santa Maria Valleys are considered to be significant, as they would add to ongoing overdraft of the regional ground water basins.

Local Impacts
Impacts to the Lompoc Terrace ground water basin would be increased due to the addition of SLC-7 demand to the ongoing requirements of active space launch complexes and other scattered facilities on South VAFB. The increased demand generated by SLC-7 would be approximately 17 percent over present South VAFB ground water use and, based on current withdrawal rates, would create an overdraft condition in the Lompoc Terrace ground water basin. Therefore, cumulative impacts are considered to be locally significant.

4.2.4 MITIGATION MEASURES

4.2.4.1 Cypress Ridge

Measures to control erosion and surface water runoff have been incorporated into the project design criteria and include temporary paving, rain water runoff retention basin, revegetation for erosion control during construction, and reclamation and revegetation of disturbed areas after completion of construction. Permanent drainage and erosion control measures would be established, in accordance with the restoration plan. Low-use water fixtures would be installed on new facilities constructed for SLC-7 to reduce water consumption.

4.2.4.2 SLC-6

Mitigation measures would involve revegetation and slope stabilization measures, where necessary, to control erosion during operations. Construction-related erosion control would not be necessary, as ground disturbing activities are not anticipated. Low-use water fixtures would be retrofitted on existing facilities.

4.2.4.3 Boathouse Flats

Mitigation measures would be similar to those for the proposed Cypress Ridge site but would probably not require as much erosion control due to the lack of steep slopes on the terrace.

4.2.4.4 Vina Terrace

Mitigation measures would be similar to those for the proposed Cypress Ridge site but would probably require significantly more erosion control measures due to the steep slopes that would exist around the launch complex.

4.3 VEGETATION

This section addresses potential impacts to vegetation resulting from construction and operation of the proposed action. Such impacts would occur as a result of grading and other construction activities related to construction of the launch complex site, access roads, and utility corridors. During operations, impacts primarily would result from effects of deposition associated with the ground cloud produced during vehicle launch.

Impacts would be considered significant if they would:

- Substantially affect a rare or endangered species of plant.
- Substantially diminish a regionally or locally important plant community.
- Substantially diminish habitat for a plant species.
- Result in a substantial infusion of exotic species.

4.3.1 REGIONAL IMPACTS

Project impacts primarily consist of removal and alteration of vegetation during construction at one of the undeveloped alternatives and the potential for disturbance from project-related emissions from all four sites during operations. As these would be local impacts, no regional impact is anticipated.

4.3.2 LOCAL IMPACTS

Implementation of the proposed action at one of the undeveloped alternatives would result in impacts to vegetation within the launch complex site, corresponding utilities corridors, and additional areas to be used for project facilities and construction needs. These impacts would include: (1) removal of portions of vegetation communities, (2) removal of individuals of special interest species, and (3) potential for establishment of exotic species in disturbed areas. These additional areas include locations for the contractor village, construction laydown sites, batch plant, truck washdown, access roads, POV parking, and sewage treatment facility. Therefore, although the final, fenced space launch complex would be about 50 acres in size, the total area to be disturbed for both the proposed and alternative sites would be considerably greater, ranging from approximately 185 to 280 acres, depending on the alternative chosen. Implementation of the SLC-6 alternative would not result in significant impacts to vegetation, since earth moving or excavation activities are not anticipated.

4.3.2.1 Cypress Ridge

Construction

Construction of the proposed action facility at the Cypress Ridge site would result in a permanent loss of approximately 90 acres of central coastal scrub and Venturan coastal sage scrub, representing less than one percent of these communities on all of VAFB. Removal of approximately 19 acres of non-native grassland represents a loss of less than 0.1 percent of the community on VAFB. Since these losses together represent less than one percent of the VAFB community, the impact is considered to be insignificant.

Construction of the electrical power line along either the proposed or alternative alignment (see Figure 2.1.7) would result in a potential area of disturbance defined by a corridor approximately 125 to 150 feet wide and about three miles long, mostly through central coastal scrub. Disturbance during placement of the electrical power poles and stringing of electric power lines may affect approximately 40 to 50 individuals of the federal candidate *Monardella undulata* var. *frutescens* although, as feasible, the power poles would be placed to avoid these sensitive plant species. Wetlands would be avoided by adjusting pole spacing to clear wetland areas. This design would preserve several small wetland areas covering about five acres and two areas of willow-dominated riparian scrub/woodland at the Red Roof Canyon and Grey Canyon crossings (near the SLC-6 External Tank Storage and Checkout Facility and Lockheed temporary storage facilities).

Construction of the underground communication (fiber-optic cable), gaseous nitrogen, and natural gas lines along the proposed alignment would have no significant impact, as these facilities would be placed primarily along existing roads and in ruderal vegetation consisting mainly of introduced species. Construction of the fiber-optic cable along the alternative alignment would be within the electric power corridor and would avoid wetland areas. Construction of the water line would have little impact on vegetation, as the corridor would follow Coast Road over most of its distance.

Approximately 800 to 1,000 mature individuals of *Monardella undulata* var. *frutescens* would be lost as a result of construction of the proposed action at the Cypress Ridge site. This represents an estimated 25 to 50 percent of the individuals in known populations south of Honda Canyon. Although there are an estimated 950,000 individuals of this taxon on the San Antonio Terrace (a portion of its suitable habitat) (HDR Science 1980), the populations at the Cypress Ridge site are important because these plants are at the southern limit of their range (Smith 1983), and their

loss, therefore, would be a significant impact. This significant impact would be reduced to an acceptable level by undertaking suggested mitigation measures. Other special interest taxa that could be affected are listed in Appendix B, Table B.2.

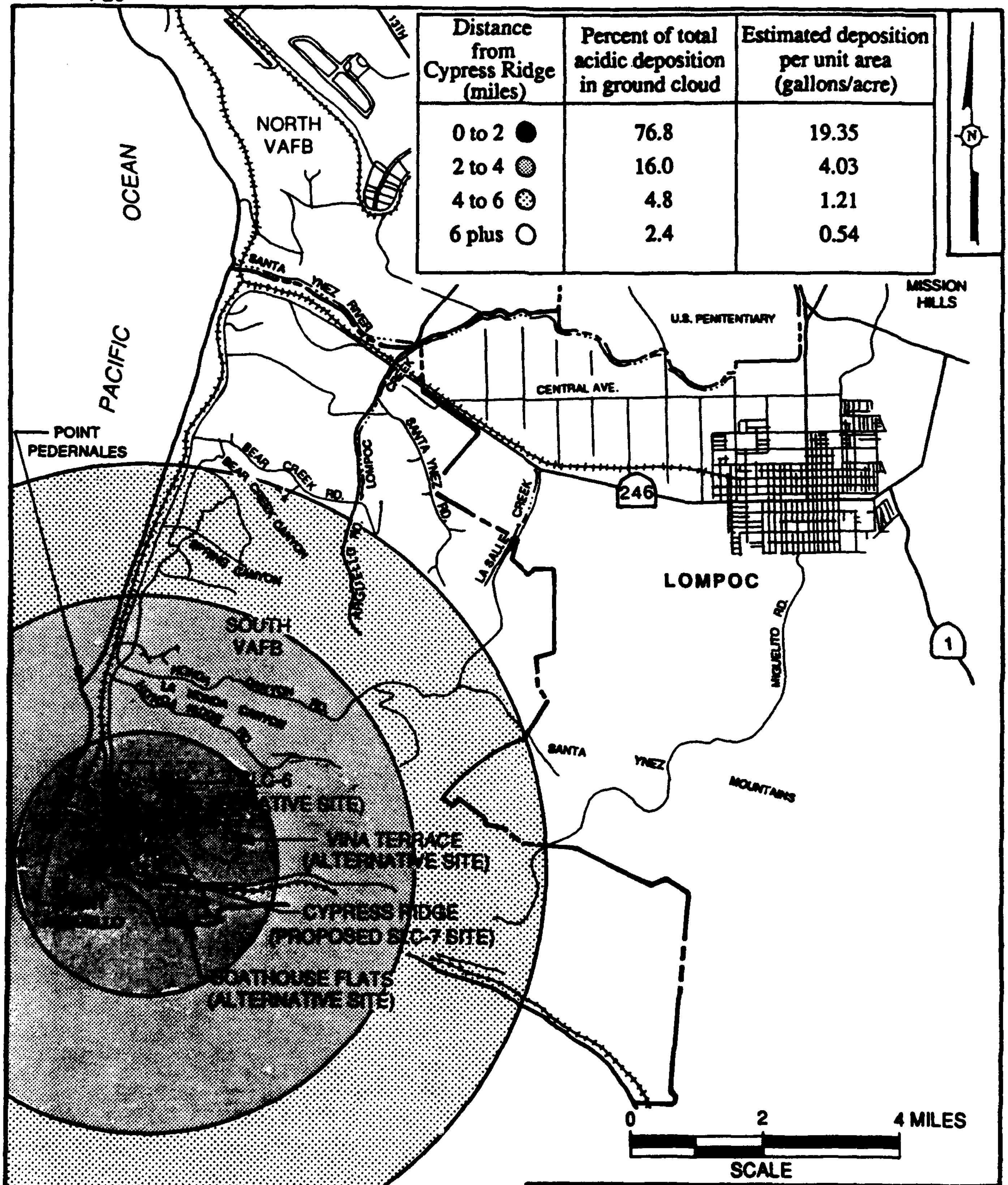
The invasion of construction-disturbed areas by exotic plants is a potential impact to vegetation. Sites disturbed by construction activities are prone to exotic plant invasion, due to the absence of competing vegetation. Once established, the exotics can spread to previously pristine plant communities. Exotic invasive plants such as Hottentot-fig *(Carpobrotus edulis)*, Andean grass *(Cortaderia jubata)*, and slender-leaf iceplant *(Conicosia pugioniformis)* are undesirable on VAFB. These weeds impact native vegetation through direct competition for light, water, and nutrients (Coulombe and Cooper 1976; Schmalzer et al. 1988).

Operations

Impacts to vegetation near the launch complex may occur during launches as a result of acidic deposition (hydrochloric acid) formed by contact of the deluge water with exhaust components of the SRMUs. Acute vegetation damage has occurred in Space Shuttle exhaust cloud paths less than 0.6 mile from the launch pad at Kennedy Space Center (Schmalzer et al. 1986). Although the Titan IV/Centaur would have smaller SRMUs and require smaller deluge sprays than the Space Shuttle, some discernable impact to vegetation from its exhaust may occur. Impacts could include damage to sensitive species, change in vegetation cover type resulting from changes in the soil seed bank as species are lost, soil erosion resulting from loss of vegetative cover (Zammit and Zedler 1988), and loss of special interest plants.

During the initial liftoff, the SRMUs fire with resulting ignition products of hydrogen chloride gas (HCl), aluminum oxide (Al_2O_3), carbon monoxide (CO), and water (H_2O). Of the approximately 26,000 gallons of deluge water used during initial liftoff, about 20,000 gallons evaporate and form a ground cloud. (This contrasts to approximately 44,000 gallons which evaporate from each launch of the Space Shuttle at Kennedy Space Center). As the ground cloud condenses, it forms water droplets which scavenge the HCl gas and form hydrochloric acid droplets (NASA 1983).

Deposition of the hydrochloric acid droplets on surrounding vegetation has been estimated to result in impacts when pH levels approach 3.0. These impacts could include partial or complete defoliation and a decline in seedling survivorship, seed germination response, and seedling emergence (NASA 1987). Figure 4.3.1 (Near-field Acidic Deposition, Titan IV/Centaur Launch)



Distance from Cypress Ridge (miles)	Percent of total acidic deposition in ground cloud	Estimated deposition per unit area (gallons/acre)
0 to 2 ●	76.8	19.35
2 to 4 ◍	16.0	4.03
4 to 6 ◌	4.8	1.21
6 plus ○	2.4	0.54

WIND SPEED = 9.8 MILES PER HOUR
COMPUTATION PERFORMED BY TRAJM (NASA 1983)
SOURCE: USAF 1987a.

FIGURE 4.3.1

NEAR-FIELD ACIDIC DEPOSITION TITAN IV/CENTAUR LAUNCH

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shows the estimated concentration (extent) of acidic deposition over distance from the center of launch. The figure shows that vegetation within a downwind distance of approximately three miles could be expected to be impacted to some extent. However, due to dispersion of the ground cloud, potential impacts would decrease with distance from the launch site. After a launch, Al_2O_3 also would be expected to fall out from the ground cloud. However, studies of Al_2O_3 have shown it not to be harmful to plant life (USAF 1983b).

The impacts resulting from launch of a Titan IV/Centaur from the proposed Cypress Ridge site would not be known with certainty until after the launch. However, indications from experience with the Space Shuttle indicate that most of the anticipated impacts to vegetation would occur within three miles of the launch site, with the greatest impact within 0.6 mile (NASA 1987).

Populations of *Monardella undulata* var. *frutescens* are located approximately one-half mile southwest of the proposed launch site (about 400 mature individuals), and about 50 individuals are located one-third mile north-northwest of the site. Although unlikely due to prevailing wind direction, these populations may be affected by ground cloud deposition. A population of approximately 50 individuals of surf thistle (*Cirsium rhothophilum*), another federal candidate species, occurs outside of the study area near Rocky Point, approximately 0.7 mile west of the launch pad site. Given the distance and wind direction normally associated with a launch, this plant population may not be affected.

There could be impacts to plant life as a result of a catastrophic event, although such impact is expected to be insignificant. For example, the potential for vegetation to experience direct contact with spilled fuel would be minimized by provision of fuel and fuel waste impoundments and the flame duct and retention basin. In the event of a solid rocket burn on the launch pad, there would be locally high levels of HCl deposition. However, based on observations of nearby vegetation after the Titan 34-D explosion at SLC-4 in April 1986, the occurrence of such impact at the Cypress Ridge site would not be significant. Further, in the case of a wildland fire resulting from a launch anomaly, there would be little long-term impact from the fire itself, as the natural plant communities surrounding the proposed launch complex are adapted to periodic burning. However, such fire could result in secondary impacts from invasion by exotic plants (Hickson 1987). Overall, significant impacts from catastrophic events are not anticipated.

4.3.2.2 SLC-6

Construction

Since no earth moving or excavation activities are anticipated at the SLC-6 site, impacts to vegetation would be minimal and would not be significant. In addition, selection of the SLC-6 alternative would avoid construction impacts at an undeveloped site.

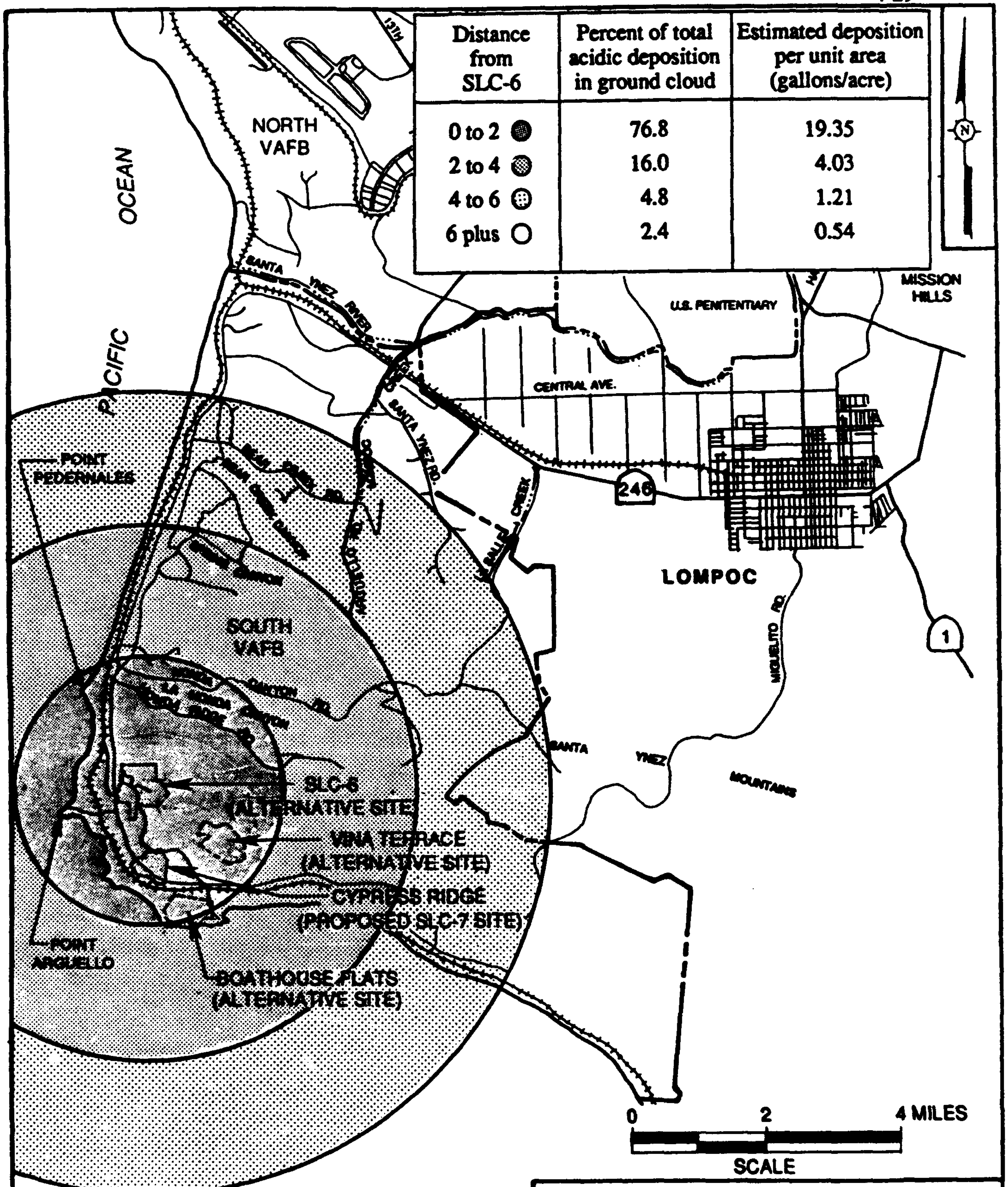
Operations

Impacts from operations at this site would include possible vegetation damage from acidic mist deposition during launches, as described for the Cypress Ridge site. The approximate boundaries of acidic deposition resulting from a Titan IV/Centaur launch from SLC-6 are shown in Figure 4.3.2 (Near-field Acidic Deposition, SLC-6 Site, Titan IV/Centaur Launch). The impacts of this deposition would not be known with certainty until after a launch. However, indications from experience with the Space Shuttle indicate that most of the anticipated impacts to vegetation would occur within three miles of the launch site. The greatest impact would be expected within 0.6 mile (NASA 1987).

Special interest species which could be affected include a population of about 300 to 350 mature individuals of *Monardella undulata* var. *frutescens*, located about 2,000 feet southwest of SLC-6. Other populations of this species are located south of Cypress Ridge. Due to topography and distance, the potential effects of acidic deposition on these populations could be somewhat less from a launch at SLC-6 than from a launch at one of the undeveloped sites.

A large population of surf thistle (*Cirsium rhothophilum*), a federal candidate species, occurs approximately one mile west of SLC-6 at Point Arguello. A smaller population of about 50 individuals occurs approximately 1.2 miles southwest, at Rocky Point. Given the distance from the potential SLC-6 launch site and the wind direction normally associated with a launch, these plant populations may not be affected.

Impacts from catastrophic events would be insignificant, comparable to those described for the Cypress Ridge site.



Distance from SLC-6	Percent of total acidic deposition in ground cloud	Estimated deposition per unit area (gallons/acre)
0 to 2	76.8	19.35
2 to 4	16.0	4.03
4 to 6	4.8	1.21
6 plus	2.4	0.54

WIND SPEED = 9.8 MILES PER HOUR
COMPUTATION PERFORMED BY TRAJM (NASA 1983)
SOURCE: USAF 1987a.

FIGURE 4.3.2

NEAR-FIELD ACIDIC DEPOSITION SLC-6 SITE TITAN IV/CENTAUR LAUNCH

SLC-7 ENVIRONMENTAL IMPACT STATEMENT

4.3.2.3 Boathouse Flats

Construction

The permanent loss of approximately 130 acres of non-native grassland would result from construction of the launch complex at this site. This would have little regional impact, since it would represent less than one percent of this community on VAFB. Potential impacts from exotic plant invasion are present, but would be less serious here than at Cypress Ridge, as there is less sensitive habitat at this site.

Temporary disturbance of 50 to 100 mature individuals of the federal candidate *Monardella undulata* var. *frutescens* could result from construction of the power line, but additional suitable habitat might be created as a result of its construction. Construction of the water pipeline would result in the disturbance of a 5-foot wide corridor, approximately two miles long, through central coastal and Venturan coastal sage scrub, and less than one acre of willow-dominated riparian scrub in Oil Well Canyon. As at the Cypress Ridge site, impacts to wetlands and riparian scrub/ woodlands are not likely. Impacts from construction of the underground communication, gaseous nitrogen, and natural gas lines would be insignificant, since primarily ruderal vegetation would be disturbed.

Operations

Impacts from operations at this site would include possible vegetation damage from acidic mist deposition during launches, as described for the Cypress Ridge site. The nearest large populations of the federal candidate plant *Monardella undulata* var. *frutescens* (roughly 600 and 400 mature individuals each) occur approximately one mile northeast of the proposed launch pad. The population of surf thistle *(Cirsium rothophilum)* near Rocky Point is approximately 1.3 miles northwest of the launch pad. The prevailing wind direction at VAFB makes it unlikely that these populations would be affected by acid deposition. Accelerated soil erosion from loss of vegetative cover is also unlikely on this level site, except possibly on the cliff faces.

Impacts from catastrophic events would be the same as described for the Cypress Ridge site.

4.3.2.4 Vina Terrace

Construction

A permanent loss of approximately 65 of the 90 acres of central coastal scrub and 30 of the 45 acres of grassland and grassland-coastal scrub would occur from the construction of the proposed action at the Vina Terrace site. Potential impacts of invasion by exotic species would be less serious than Cypress Ridge, but of greater consequence than at Boathouse Flats.

An estimated 60 acres of central coastal scrub, seven acres of Venturan coastal sage scrub, and less than one acre of willow-dominated riparian scrub would be cleared for construction of the access road and utility and water lines across Oil Well Canyon. About one mile of this road would follow an existing unpaved road, the widening of which would impact an unknown amount of native bunchgrass-dominated grassland. The impacts to central coastal scrub along the proposed power line route north of the Lockheed temporary storage facilities and to riparian scrub/woodland at the Red Roof and Grey Canyon crossings would be the same as for the Cypress Ridge site. No known federal candidate species or special interest plants would be affected.

Operations

Impacts from operations at the Vina Terrace site could include possible vegetation damage and possible accelerated soil erosion due to vegetative cover removal and from acidic deposition during launches, as discussed for the Cypress Ridge site. Because of the steep slopes, the potential for soil erosion is greater at this site than at the Cypress Ridge, SLC-6, or Boathouse Flats sites. No known federal candidate species would be affected by operations at the Vina Terrace site.

Impacts from catastrophic events would be insignificant, as they would be the same as described for the Cypress Ridge site.

4.3.3 CUMULATIVE IMPACTS

The cumulative impact to terrestrial vegetation would result from the addition of one of the three potential undeveloped sites to the four existing launch complexes on South VAFB (SLC-3, -4, -5, and -6). The four existing launch complexes and their associated facilities occupy approximately

425 acres (Provancha 1988). Based on analysis of soil type and topography, it appears that most of this area was originally central coastal scrub habitat, although much of it was cultivated or grazed prior to 1930.

Locating SLC-7 on the proposed Cypress Ridge site would result in essentially the permanent loss of an additional approximately 85 acres of central coastal scrub, and on the Vina Terrace alternate site a loss of approximately 65 acres of an estimated total coverage on VAFB of 31,000 acres (Provancha 1988). Although these are small percentages, central coastal scrub and other coastal scrub communities are rapidly being lost in areas outside of VAFB. It has been estimated (Westman 1981) that only 10 to 15 percent of the original habitat remains. The requirement of large safety clear zones around launch facilities at VAFB ensures that areas of this and other vegetation communities would remain undeveloped, at least into the near future. This impact, therefore, is not considered to be significant.

Locating the proposed action at SLC-6 would not contribute to cumulative impacts, as no new disturbances to vegetation would occur.

4.3.4 MITIGATION MEASURES

4.3.4.1 Cypress Ridge

Construction and operation of SLC-7 at this site would not affect any federal- or state-listed threatened or endangered plants. USAF Regulation 126-1, Conservation and Management of Natural Resources, Chapter 5, paragraph 12, March 20, 1984, states that species proposed for or under review for federal listing (candidate species) should be considered in environmental planning and be provided protection when feasible. The loss of 800 to 1,000 mature individuals and at least as many seedlings of the candidate plant *Monardella undulata* var. *frutescens* at the southern limit of its range due to construction at the Cypress Ridge site would constitute a locally significant impact to the present distribution of this species. The opportunity would be provided for interested parties (representatives of herbaria and botanic gardens, universities, CNPS, etc.) to recover specimens of special interest plants that would otherwise be taken by construction.

Measures would be enacted to reduce impacts from construction activities. These would include pre-planning to minimize the extent of land disturbed for laydown and stockpile areas and utility corridors. Prior to construction, an access corridor and turn-around area(s) would be staked. Construction vehicles and activities would be limited to the staked area. Other construction vehicle

travel would be limited to designated roads. These areas to be avoided would be shown on a construction map. Areas of special interest species and habitats that could be avoided would be flagged and, as appropriate, an environmental monitor would be present during clearing and grading activities. An area of particular interest is the proposed construction laydown area southwest of the SLC-6 External Tank Storage and Checkout Facility, near a large population of curly-leaved monardella. Power poles would be placed to avoid wetlands and would be located to minimize impacts to monardella.

The top six inches of topsoil would be stockpiled during construction of the launch complex and utility corridors and re-spread over disturbed areas once construction is complete. This would enable revegetation to occur by seeds present in the topsoil. If erosion is likely to occur, disturbed areas would be revegetated with endemic plants, preferably with local seed or with approved, non-invasive, naturalized species. Revegetation would be monitored and, to allow for future interpretation, records would be kept of the seed sources and the revegetated locations. Soil stabilization measures would be utilized, such as the installation of erosion control fabric, soil cement, and/or gunite on areas of steep slopes or highly erodible soils. Erosion maintenance would be incorporated into a long-term site restoration and reclamation plan.

A monitoring program would be established to assess operational air emissions impacts to vegetation, with an emphasis on sensitive species.

An erosion control and restoration plan would be prepared to address those areas affected by construction of project facilities and operation of the space launch complex. The plan would address measures to be taken during both the four-year construction phase and over the long-term life of the proposed facility. The plan would specify mitigation measures for issues such as erosion control, revegetation and reclamation of disturbed areas, treatment of sensitive species, primarily monardella, and treatment of sensitive wetland areas. These measures would include the monitoring and control of exotic plants to mitigate impacts from weed invasion of disturbed construction areas, in accordance with USAF Regulations 126-1 and 19-7. Criteria for development of the plan are included in the Biological Assessment (Environmental Solutions 1989b).

4.3.4.2 SLC-6

Implementation of the proposed action at the SLC-6 site would not result in construction-related disturbance to vegetation. Therefore, construction mitigation measures would not be required. However, to reduce the impact of operations on the local vegetation community, the operational mitigation measures for the Cypress Ridge site would be implemented.

4.3.4.3 Boathouse Flats

An insignificant number of individuals of the federal candidate *Monardella undulata* var. *frutescens* would be lost if the Boathouse Flats site were chosen, and no mitigation for its loss would be necessary. To reduce the impact of construction and operations on vegetation, the mitigation measures for the Cypress Ridge site would be implemented.

4.3.4.4 Vina Terrace

To reduce the impact of construction and operations on vegetation, the mitigation measures for the Cypress Ridge site would be implemented.

4.4 WILDLIFE

This section addresses potential impacts to terrestrial and marine wildlife resulting from construction and operation of the proposed project. Impacts during project construction primarily would be related to habitat removal during grading of one of the undeveloped sites. During operations, impacts primarily would be related to launch events and the potential effects of associated launch noise, sonic boom, and ground cloud deposition at any of the four potential sites.

Impacts to wildlife would be considered significant if they would:

- Substantially diminish habitat for a terrestrial or marine species.
- Substantially affect a rare or endangered species of animal or its habitat.
- Interfere substantially with the movement of resident or migratory wildlife species.
- Interfere substantially with reproductive behavior.

4.4.1 REGIONAL ENVIRONMENT

4.4.1.1 Introduction

The primary impacts to regional biota would be potential effects of launch noise and focused sonic boom overpressure on the Channel Islands and offshore marine life, primarily marine birds and marine mammals. Construction and most operational impacts would be localized and not extend to the offshore/Channel Islands region, due to distance from the launch site. Construction impacts would be confined to the South VAFB area. Potential operations impacts related to air emissions, normal operational noise, and deluge and washdown water resulting from launch events would be confined to the South VAFB area.

Launch noise and focused sonic booms and their short- and long-term impacts on marine birds and mammals are studied in detail in the SLC-7 Biological Assessment (Environmental Solutions 1989b). Computer modeling for prediction of the focused sonic boom was completed for the proposed action. Documentation and results of the focused sonic boom and footprint are included as an appendix to the "Biological Assessment, Space Launch Complex 7" (Environmental Solutions 1989b). Launch-related noise was approximated from Titan IV values at SLC-4 and resolved to SLC-7 coordinates.

The alternative SLC-6, Boathouse Flats, and Vina Terrace sites are proximal (within about one mile) to the Cypress Ridge site. Therefore, the sonic overpressures and launch-related noise determined for the proposed Cypress Ridge site are considered to be the same at the three alternative sites.

The trajectory and nearfield signature of the Titan IV/Centaur and local meteorology were input as variables for a simulated computer model to predict the worst-case magnitude, footprint, and signature subsequent to launch and ascent of the Titan IV/Centaur. This case was assumed by choosing an overflight path coincident with the Channel Islands and by assuming unfavorable meteorological conditions (i.e., no wind).

A 10-pound per square foot (psf) magnitude and ground intersection footprint of the focused sonic boom, shown in Figure 4.4.1 (Titan IV/Centaur Sonic Boom Footprint), occurs within the focal region of the Channel Islands, with the greatest potential impact being to San Miguel Island. The time duration signature is shown in Figure 4.4.2 (Simplified Focus Signature).

The greatest noise associated with operation of the proposed action would result from scheduled launches and potential unscheduled events. Impacts to marine birds and mammals from sonic booms and launch-related noise have been assessed for physical effects (physiological damage) and startle effects (behavior, breeding, and stampeding). A Titan IV/Centaur launch could produce sufficient noise to result in physiological damage, such as temporary hearing impairment, to marine biota within the focal range of the sonic boom expected to occur over the northern Channel Islands. The threshold for temporary auditory damage from exposure to a single sonic boom has been found to occur in the range of 138 dB to 169 dB (Chappell 1980). The maximum, worst-case, A-weighted sound level expected to be produced during a Titan IV/Centaur launch is 147 dBA (Environmental Solutions 1989b), based on a predicted overpressure of 10 psf. This level is within the threshold for temporary auditory damage and would cause minor and temporary hearing loss in sensitive wildlife species. Other launch scenarios (azimuths not coincident with the Channel Islands and varying wind and temperature conditions) would result in lower sound levels and would be expected to result in less auditory impact to marine biota.

Startle responses in marine birds and mammals are known to occur at impulses of as little as 80 to 90 dB flat SPL (Bowles and Stewart 1980). Noise of this intensity may occur within 20 to 30 miles of the launch site, thus leading to potential impacts to biota of the northern Channel Islands. Mammals and birds will generally run or fly in response to sonic booms and loud overflights (Speich et al. 1987; Bowles and Stewart 1980). However, despite rather intensive

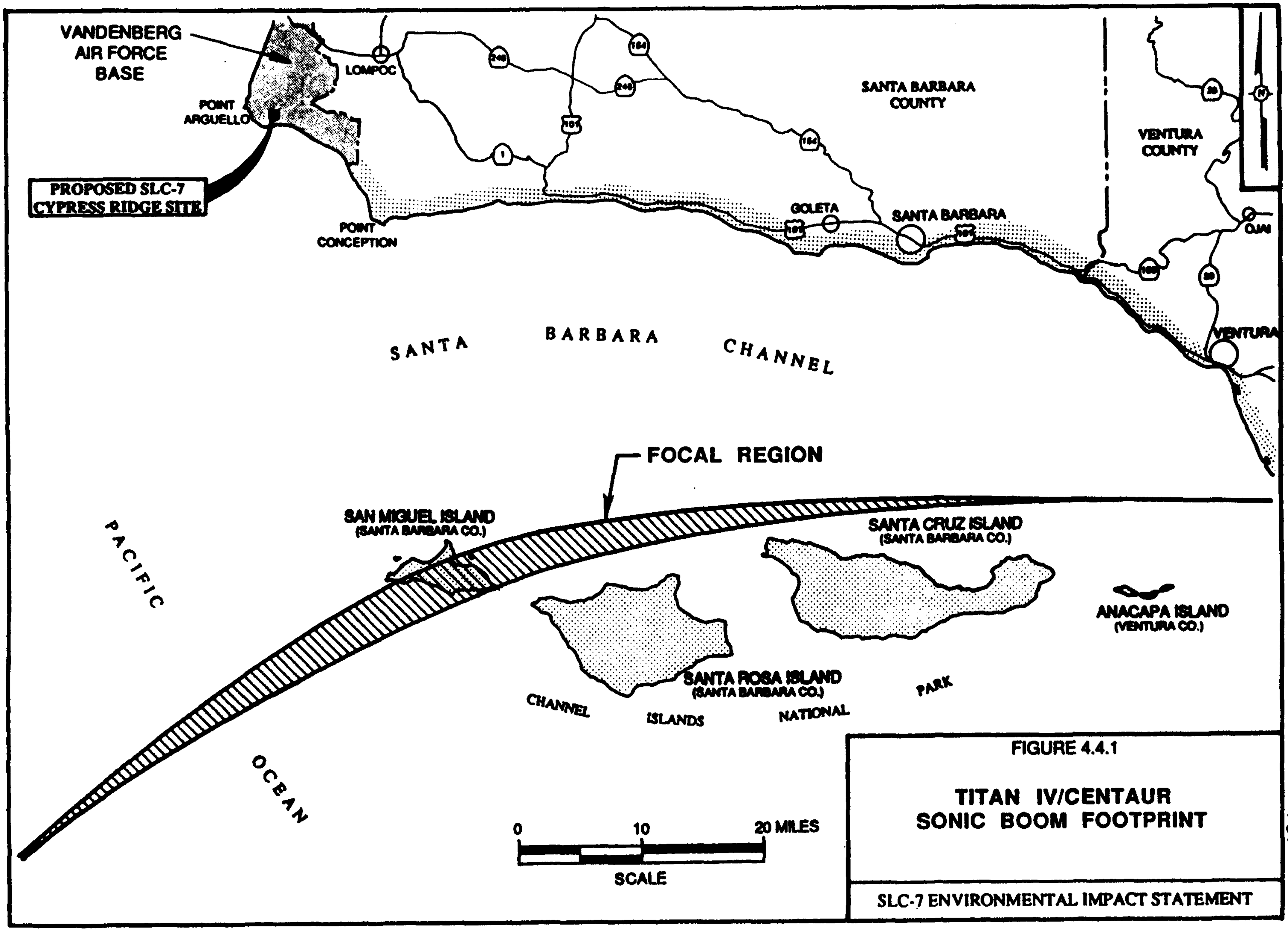


FIGURE 4.4.1

TITAN IV/CENTAUR SONIC BOOM FOOTPRINT

SLC-7 ENVIRONMENTAL IMPACT STATEMENT

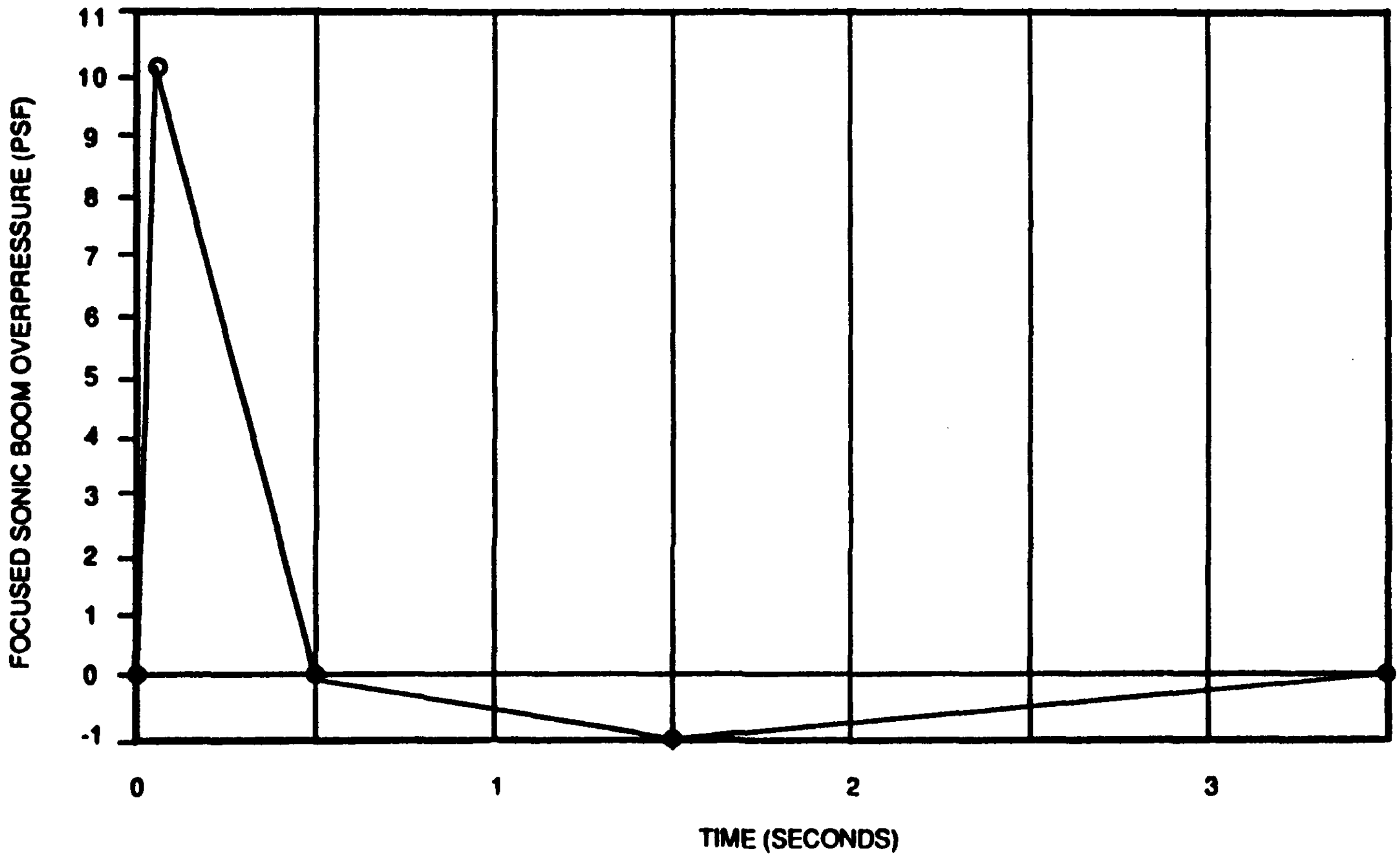


FIGURE 4.4.2

SIMPLIFIED FOCUS SIGNATURE

SLC-7 ENVIRONMENTAL IMPACT STATEMENT

long-term studies, there is no evidence that dangerous leaping, self-damage, crushing, or breeding colony abandonment occur with either marine birds or marine mammals as a result of startle responses brought on by sonic booms or loud overflights (Bowles and Stewart 1980; Schreiber and Schreiber 1980; Black et al. 1984; Speich et al. 1987).

4.4.1.2 Marine Birds

Noise generated during launch and sonic booms focused over the Channel Islands would result in short-term, localized, and insignificant impacts to marine birds. No long-term impacts, such as auditory, physiological, or ecological damage, are expected to occur as a result of sonic booms or noise generated during space vehicle launches. Launch noise is expected to result in short-term impacts, such as temporary hearing impairment, to marine birds within a radius of about three to five miles of the project area. Marine birds which nest in the Rocky Point to Point Pedernales area (i.e., pelagic cormorant, pigeon guillemot, Western gull, rhinoceros auklet) could suffer temporary hearing impairment as a result of exposure to launch noise, but this impact is not expected to result in occurrences of colony abandonment. California least terns and brown pelicans would not be adversely affected by Titan IV/Centaur space vehicle launches from the South VAFB project area. Impacts from launch noise are expected to be minimal and insignificant to the California least tern nesting colonies at the mouth of the Santa Ynez River and at Purisima Point.

Focused sonic booms are not expected to produce significant, long-term impacts to marine bird colonies on San Miguel Island for the reasons stated above. Minor egg losses may occur in Western gull colonies on San Miguel Island, but these are not expected to significantly impact populations. Measurable egg loss is not expected to occur in cormorant nesting colonies on the island as a result of sonic booms. The nearest brown pelican nesting colony occurs on west Anacapa Island, which has a low probability of receiving focused sonic booms from these launches.

4.4.1.3 Marine Mammals

Launch noise and related sonic booms may have two effects on marine mammals (sea otters and pinnipeds) out of water. If the sound pressure levels are strong enough and within a certain frequency range, they could cause temporary or permanent hearing loss. Analyses done for the Space Shuttle predicted maximum focused sonic boom overpressures of 30 psf (156 dB) and indicated that permanent hearing loss was not likely, but that some temporary hearing threshold

shift was possible for animals in the zone of sonic boom focus (Chappell 1980). Secondly, loud booms could create startle responses manifested by stampeding to the water. If this occurred during critical points in the reproductive cycle of any of the four breeding pinniped species, it could result in a potential impact to their respective populations, such as causing adults to abandon a breeding ground, nursing females to abandon their pups, or pups to be crushed by stampeding adults. However, the maximum predicted sonic overpressure for the Titan IV/Centaur is 10 psf (147 dB). Based on results of the Space Shuttle analysis, launches of the Titan IV/Centaur would be expected to result only in minor, short-term hearing losses.

The exact nature of startle response to loud sonic booms would probably differ among the four pinniped species currently breeding at San Miguel Island. Bowles and Stewart (1980) provide an account of potential reaction of these pinnipeds and indicate that California sea lions and harbor seals may be the most reactive. They also point out that, within the California sea lion population, individual responses to loud booms may vary as a function of seasonal or age related sensitivity. The same may be true to varying degrees among the other species.

Potential startle impacts are expected to be most prevalent at San Miguel Island. The responses of California sea lions, as well as Northern fur seals, were observed during two breeding seasons (Bowles and Stewart 1980; Stewart 1981). Both species were reported as responding (running) in reaction to aircraft overflights and sonic booms. The observers, however, did not record evidence of crushed pups, panic leaping, overheating due to over-exertion, or mother-pup separation. There were no other reports in literature which contradicted these findings.

The Guadalupe fur seal is only occasionally sited in the northern Channel Islands and would not be impacted by launches of the proposed Titan IV/Centaur.

Harbor seals reportedly are more sensitive to disturbance than are other pinnipeds in the VAFB region. However, they are not likely to permanently abandon favored hauling sites, particularly not in response to noise stimuli unaccompanied by a visual stimulus (Stewart 1981; Speich et al. 1987). Mother-pup separations are subject to some controversy, but purely acoustic stimuli, such as sonic booms on San Miguel Island, result in relatively controlled movements which allow pups to follow their mothers (Bowles and Stewart 1980; Stewart et al. 1988).

The frequency of Titan IV/Centaur launches would be three per year. At the most, only one launch per year would occur during the pupping season. Based on breeding statistics for San Miguel Island (Stewart et al. 1988), only pups less than two hours old could be separated from their

mothers during a major startle. On San Miguel Island, 100 to 120 pups are born each year over a 75-day breeding period, with a maximum of two to three per day born during the peak period. Only one sonic boom from a Titan IV/Centaur would be possible during this period, so the probable risk and potential consequence of mother-pup separation is small.

Launch-related impacts to the one mustelid (sea otter) that occurs in the region are not anticipated. The sea otter occurs periodically rather than regularly, and sightings north of Santa Barbara are occasional. The closest breeding grounds, based on sightings north of VAFB, are north of Pismo Beach.

The occasional occurrence of marine turtles off the coast of VAFB is not expected to result in adverse impacts to individuals of this species. Gray whales are known to pass within 100 miles of the VAFB shoreline during the annual winter-spring migration, but adverse impacts are not expected due to the relatively infrequent launches and the sharp attenuation of noise-related effects below the air/water interface.

As discussed herein, no significant effect to marine mammals is anticipated. However, there is the potential for certain insignificant impacts to occur. Therefore, in compliance with the requirements of Section 7(a) of the Endangered Species Act, as administered by the National Marine Fisheries Service and the U.S. Fish and Wildlife Service, and subsequent to their review of the Biological Assessment (Environmental Solutions 1989b), a Small Incidental Take Permit may be required. Such permit is now being processed for the current SLC-4 project that, like SLC-7, is located on South VAFB. Based on the similarity of both the characteristics and potential impacts of the two projects, it is anticipated that a Small Incidental Take Permit also may be required for the proposed SLC-7 project. It is expected that this would be similar to or a modification of the permit issued for SLC-4.

4.4.2 LOCAL TERRESTRIAL ENVIRONMENT

This section provides an assessment of the environmental impacts resulting from construction and operation of the proposed project at VAFB on the terrestrial environment of the project area. Impacts are assessed in greatest detail for the proposed site at Cypress Ridge. Impacts at the alternative SLC-6, Boathouse Flats, and Vina Terrace sites are discussed if they differ appreciably from those assessed for the Cypress Ridge site. The importance of a potential impact was determined by assessing the significance of the resource affected, its sensitivity to disturbance, and the extent of the affected resource relative to its presence in the project area and study region.

Impacts from construction, operations, noise, and launch-related sonic booms are discussed relative to their potential effects on terrestrial wildlife, threatened and endangered species, and marine wildlife within the immediate project area.

4.4.2.1 Cypress Ridge

Construction

Potential impacts to wildlife from construction of the proposed action include: (1) removal of vegetation, which could lead to permanent or temporary loss of habitat and displacement or elimination of individual resident species, and (2) degradation of the value of adjacent habitat due to air pollution, noise, human activity, or intrusion. Clearing and grading could generate construction impacts through elimination of vegetation communities (habitats) and their associated faunas. There also could be some direct mortality to burrow-dwelling and less mobile animals that inhabit the project site. More mobile wildlife such as birds and larger land mammals would be expected to move temporarily into adjacent habitat. Some of the displaced species would be lost if adjacent communities are at carrying capacity.

Removal of southern coastal bluff and coastal dune scrub, chaparral, and grassland habitats would not result in significant impacts, since these habitats: (1) are widespread on VAFB, (2) support wildlife species that tend to be common and wide-ranging both locally and regionally, and (3) are not known to support resident populations of threatened or endangered species.

Noise, increased human activity, and exhaust emissions from heavy equipment and other construction vehicles during most phases of construction would result in adjacent habitats being temporarily unattractive. Large and medium sized animals such as mule deer, coyote, skunk, hawk, and rabbit could temporarily stop using nearby areas, but at the end of construction would be expected to return to revegetated areas. An increase in road-killed wildlife would be expected during the construction phase of the project due to increased vehicle traffic. These disturbances are expected to create impacts that are insignificant, short-term, and localized.

Operations

Potential impacts to wildlife may occur as a result of occurrences such as: (1) air pollutant emissions and wastewater resulting from launch, (2) vehicle failure, (3) launch related noise and sonic booms, and (4) increase in human activity.

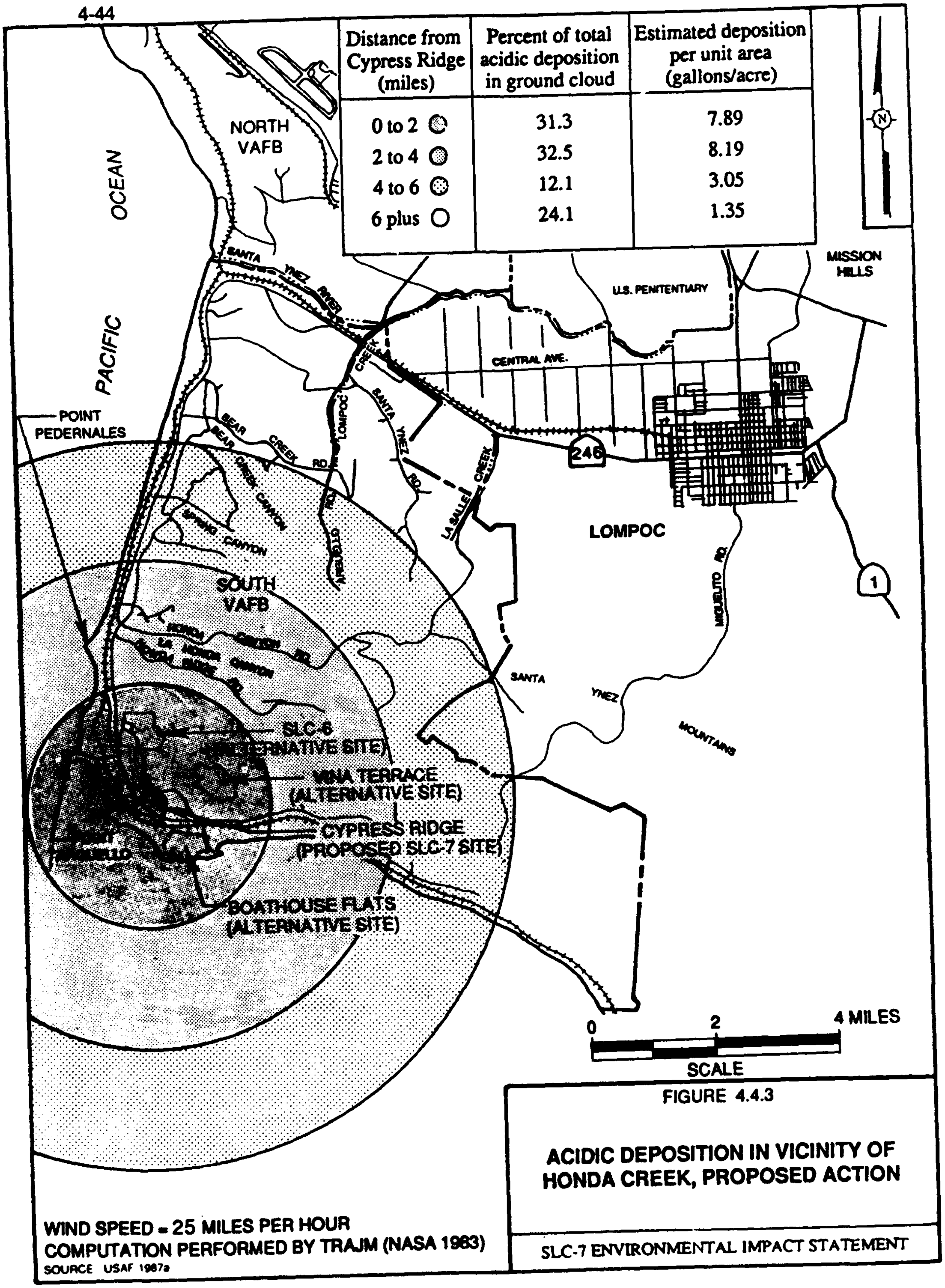
Air Pollutant Emissions and Wastewater

It is expected that air pollutant emissions from vehicle launch may result in insignificant, short-term, and localized impacts to terrestrial fauna. During a normal Titan IV/Centaur launch, emissions of aluminum oxide (Al_2O_3) and hydrogen chloride (HCl) could impact terrestrial biota. However, previous studies have shown that actual operational emissions of these substances have been considerably lower than predicted and have not resulted in significant impacts (Engineering Science 1987, Engineering Science and Sea World Research Institute 1988).

There could be an acidic mist of pH 3.0 or less formed by contact of the deluge water with the solid rocket motor exhaust during ignition. Terrestrial animals in the vicinity of the launch site could come into contact with this acidic deposition for a short period of time. However, this contact is not expected to be significant since the exhaust cloud would be present for only a short time and mist, which settles, would evaporate within a relatively short period of time. In addition, pre-launch monitoring of meteorological conditions would enable the USAF to avoid conducting launches during periods when ground clouds would be likely to persist.

There also is the possibility for acidic deposition to fall into streams and nearby bodies of water, thereby potentially lowering the pH of the affected water. Figure 4.4.3 (Acidic Deposition in Vicinity of Honda Creek, Proposed Action) shows the extent of acidic deposition under worst-case meteorological conditions (wind speed of 25 mph). As shown, the greatest acidic deposition would occur within two to four miles of the Cypress Ridge launch site. However, acidic deposition in Honda Creek would be neutralized by the cations present in the water, thereby reducing the possibility of a pH change that could affect the resident population of unarmored three-spined stickleback. Further discussion on this subject is presented in Appendix D (Technical Memorandum, Acidic Deposition, Titan IV/Centaur Launch from Proposed Cypress Ridge site).

Air pollutants present in the exhaust plume from a Titan IV/Centaur launch could result in short-term, localized impacts to terrestrial biota exposed to initially high concentrations of pollutants (Engineering Science and Sea World Research Institute 1988). Birds flying through the exhaust plume might be exposed to concentrations of HCl, which could irritate eye and respiratory



Distance from Cypress Ridge (miles)	Percent of total acidic deposition in ground cloud	Estimated deposition per unit area (gallons/acre)
0 to 2	31.3	7.89
2 to 4	32.5	8.19
4 to 6	12.1	3.05
6 plus	24.1	1.35

FIGURE 4.4.3

ACIDIC DEPOSITION IN VICINITY OF HONDA CREEK, PROPOSED ACTION

tract membranes. Since most birds would be frightened away by the noise, it is unlikely that many would come into contact with the exhaust plume. Exposure to Al_2O_3 would not be expected to impact resident wildlife populations. The Al_2O_3 would have a relatively short-term presence in the atmosphere. Further, it is known to have a low toxicity for humans and so is not expected to adversely affect animals.

Previous Titan II launch operations at SLC-4, test firings for solid rocket propellants at the CSD facilities in San Jose, California, and the Titan 34D vehicle failure in April 1986 at SLC-4 have not resulted in significant effects to terrestrial biota in the vicinity of the launch and testing sites (Brown and Caldwell 1986, Engineering Science and Sea World Research Institute 1988).

The launch of a Titan IV/Centaur would generate about 126,000 gallons of wastewater per launch. A retention basin incorporated into the exhaust duct would prevent the release of washdown water into surface and coastal waters. Washdown water generated at the Cypress Ridge site would be transported to the SLC-6 wastewater evaporation ponds or wastewater treatment plant or a new treatment facility at Cypress Ridge. Therefore, there would not be significant impact to terrestrial biota as a result of normal deluge and washdown water discharges. Containment areas within the launch complex boundary would control accidental release of spilled propellants. Further discussion of wastewater management is in Section 4.6.

The federal- or state-listed wildlife species known to be in the vicinity of the Cypress Ridge site are transient and migrant, such as peregrine falcon, brown pelican, and California least tern, and would be subject to localized, short-term impacts from exposure to air emissions. The unarmored three-spine stickleback, a federal- and state-listed endangered species, and the tidewater goby, a Category 2 candidate species proposed for federal listing, both occur in Honda Creek. However, due to their distance of approximately three miles from the Cypress Ridge site, and the prevailing wind direction (NW to SE), project operations would not be expected to significantly impact the habitats of either species. There would be no significant impact to the habitat of other listed species of wildlife that are known to be present in the region as a result of operation of the proposed action. Regionally rare and declining animals known to occur on the Cypress Ridge and alternative sites, such as Northern harrier, prairie falcon, burrowing owl, least Bell's vireo, Wilson's warbler, and badger, are not expected to be exposed to significant impacts from project operations.

Launch Anomaly

There is limited potential for a catastrophic accident during launch. As such, the potential impact to terrestrial fauna is judged to be insignificant. If an explosion were to occur with the launch vehicle still on the launch pad, most animals within a few hundred feet of the blast would die, and a wildfire would likely ensue. Such a fire would have the potential to kill additional animals in habitats adjacent to the launch site, but would likely be insignificant based on the fact that: (1) there were no observable adverse impacts on biota in the vicinity of SLC-4 following the Titan 34D explosion of April 1986, and (2) the habitats and their associated biota which are present in the vicinity of the launch site are adapted to, and thus tolerant of, naturally occurring wildfires.

Launch Noise and Sonic Boom

Noise can impact animals in a number of ways. In the short-term, noise can cause hearing damage and impairment, and trigger traumatic startles (i.e., startles in which animals damage themselves or others). In the long-term, noise can cause changes in the distribution and abundance of affected species or alter predator-prey interactions which might lead to ecological changes (Janssen 1978). Since launches from the proposed Cypress Ridge site would be limited, intensive events, their effects are expected to be short-term (Engineering Science and Sea World Research Institute 1988). Thus, this analysis will be confined to potential short-term effects of noise on wildlife in the vicinity of the launch site.

Noise from Titan IV/Centaur space vehicle launches could result in temporary physiological damage, such as short-term hearing impairment, to terrestrial biota within a three- to five-mile radius (Engineering Science and Sea World Research Institute 1988). Temporary hearing impairment has been recorded with humans at 115 to 120 dBA (Engineering Science and Sea World Research Institute 1988). Titan IV/Centaur launches would exceed this level only within a three-mile radius of the launch site. The threshold for auditory damage from exposure to a single sonic boom has been found to occur in the range of 138 dB to 169 dB (Chappell 1980). The maximum A-weighted sound level expected to be produced during a Titan IV/Centaur launch outside of the launch complex is 110 dBA. Thus, this level is not expected to result in permanent auditory damage to animals in the vicinity (Engineering Science and Sea World Research Institute 1988).

Sensitive terrestrial mammals, such as kangaroo rats, coyotes, gray fox, bobcat, and mountain lion, which are known to have reasonably good low-frequency hearing, and which occur within a two- to three-mile radius of the launch site, may suffer temporary, short-term (10 to 48 hour) impacts such as hearing deficits and temporary hearing threshold shifts. Effects of these hearing

impairments are not known, but are not likely to be serious, since temporary hearing impairment will likely disappear within 10 to 48 hours (Hammernik et al. 1980). Thus, it is not expected that additional launches would result in significant impacts to terrestrial mammals.

Since most birds are relatively insensitive to sounds below 100 Hz, they are unlikely to experience auditory damage from sonic booms or launch noises. Based on studies of the American kestrel (Trainer 1946), it would appear that endangered and declining diurnal raptors, such as the peregrine falcon, bald eagle, black-shouldered kite, Northern harrier, Cooper's hawk, Merlin, and prairie falcon, probably would not be affected by noise from either a launch or subsequent focused sonic boom (Engineering Science and Sea World Research Institute 1988). Ellis (1981) could find no evidence that frequent loud (82-114 dBA) helicopter overflights affected nesting success, adult mortality, or territory use of peregrine falcons and golden eagles, nor could he find evidence of opportunistic predation on their nests after they were startled off. There are no reliable results of studies which indicate that damage would result to diurnal raptors as a result of launch noise and associated sonic booms. Studies of other land birds have found no significant effect from occasional disturbances, such as sonic booms (Teer and Truett 1973; Higgins 1974). Based on the above information, it appears that there would be no significant impact to land birds from launch noise and sonic booms generated from launches at the proposed Cypress Ridge site.

Increase in Human Activity

An increase in human activity, especially during periodic use of the External Tank Landing Facility, could affect the clusters of monarch butterflies in the Monterey cypress near the Boathouse. This species is sensitive to disturbance resulting from human activity.

4.4.2.2 SLC 6

Construction

Additional loss of wildlife habitat is not anticipated as a result of construction at the SLC-6 site, since earth moving and excavation activities are not planned. Therefore, habitat-related impacts would not occur. Further, construction of the proposed project at SLC-6 would avoid the loss of habitat that would occur from project implementation at one of the undeveloped sites. Other impacts related to construction at SLC-6 would be similar to those described for the Cypress Ridge site. These impacts would be insignificant, short-term, and localized.

Operations

Increased activity in the SLC-6 area would lead to slight changes in noise, human activity, and air quality in the area. These slight changes may initially be disruptive, but wildlife in the area would be expected to rapidly adapt. These impacts would tend to be long-term but insignificant. Exposure to air emissions during launch would produce short-term, insignificant impacts to species in the area. Impacts to the unarmored three-spined stickleback in Honda Creek would be similar to those for the Cypress Ridge site. Even though SLC-6 is closer to Honda Creek than Cypress Ridge, the buffering capacity of the water in the creek is sufficient to neutralize acidic deposition that might fall into the creek after a launch, so such impact would be insignificant. Other operational impacts to wildlife in the area would be similar to those for the Cypress Ridge site and, therefore, insignificant.

4.4.2.3 Boathouse Flats

Construction

Environmental impacts from construction of the proposed project at the Boathouse Flats site are expected to be the same as those described for the Cypress Ridge site. Disruption and loss of potential nesting habitats for American kestrel, killdeer, mourning dove, rock dove, burrowing owl, horned lark, cliff swallow, Western meadowlark, house finch, and song sparrow would result from project construction. However, due to the present degraded condition of the grassland habitat at this site, and the widespread occurrence of this habitat and its associated species elsewhere in the VAFB region, the loss of this area to wildlife is not expected to be significant. Aside from an occasional transient peregrine falcon, there are no other threatened or endangered species of land birds expected to utilize the Boathouse Flats site.

Operations

Slight changes in noise, human activity, and air quality would occur in the vicinity of the facility during normal day-to-day operations of the Boathouse Flats facility, and nearby wildlife would be expected to adapt to those changes. Although impacts would be long-term, they would be classed as regionally insignificant. During launch operations phase, exposure to air emissions or water discharges could create localized, short-term, insignificant impacts to resident, migrant, and

transient listed species and regionally rare or declining species which are known or expected to occur in the vicinity. No significant impacts to habitats of listed or candidate species are expected to result from operation of the proposed action at the Boathouse Flats site.

4.4.2.4 Vina Terrace

Construction

Environmental impacts from construction of the proposed action at the Vina Terrace site are expected to be the same as those described for the Cypress Ridge site. Although the wildlife habitats present at the Vina Terrace site are of higher quality, the loss of these habitats for construction would be classed as insignificant for the same reasons as described for the Cypress Ridge site.

Operations

The Vina Terrace site is situated in proximity to two drainages, Oil Well Canyon to the west and Cañada Agua Viva to the east. There exists the possibility that launch-related water discharges and launch clouds could impact the biota of these two drainages. Containment areas within the launch complex would be designed to prevent deluge or washdown water from entering Oil Well Canyon. However, launch clouds could result in a short-term, localized impact to terrestrial and aquatic biota, and to water quality of Cañada Agua Viva. This impact would be insignificant because: (1) this semi-perennial stream is not known to contain any resident, regionally rare, declining, or otherwise sensitive species of amphibians, reptiles, or birds, and (2) the biota of this drainage is depauperate, due in part to disturbances resulting from cattle grazing.

There are no records of listed species within the vicinity of the Vina Terrace site, nor are any listed species expected to frequent this site on a regular basis. Thus, there would be no significant impact to the habitat of listed or candidate species from operation of the proposed action. Resident, migrant, or transient regionally rare and declining species, and listed species of birds and land mammals may be subject to insignificant, short-term, localized impacts from exposure to water discharges or air emissions from operation of the proposed action at the Vina Terrace site.

4.4.3 LOCAL MARINE ENVIRONMENT

4.4.3.1 Marine Birds

Cypress Ridge

Construction

Marine birds could be impacted during construction of the proposed project by air pollution, noise, and human activity. Intrusion into offsite areas adjacent to known marine bird nesting or roosting sites could be particularly disturbing during the spring brooding season. Such disturbance could occur during deliveries by barge of the MST, and perhaps of the equipment and supplies to the External Tank Landing Facility. Due to the relative distance of the Cypress Ridge site from marine bird nesting or roosting sites, impacts from onsite construction activities are not anticipated.

Operations

There would be no discharge of deluge or washdown water into the marine environment, so there would not be impacts to marine birds. Launch- or accident-related ground clouds could result in a localized, short-term effect to marine bird nesting and roosting colonies located between Point Arguello and the Boathouse, but potential impacts would be insignificant. Localized, short-term impacts to marine birds could occur as a result of a worst-case flight failure and failure of the vehicle destruct system. The relative intensity of impact to marine birds would depend on the amount of propellant to enter the water and on the biological sensitivity of the area of impact.

SLC-6

Construction

Impacts to marine birds in the vicinity of the SLC-6 site would be minimized due to the developed nature of the site.

Operations

Impacts to marine birds are expected to be the same as those described for the Cypress Ridge site.

Boathouse Flats

Construction

Impacts to marine birds during project construction at the Boathouse Flats site are expected to be of the same type as those described for the Cypress Ridge site. However, due to the proximity of the Boathouse Flats site to the littoral zone, impacts to marine birds, which are known to forage and roost in the area, are expected to be greater during the construction phase than those described for the Cypress Ridge site. Noise, along with physical and visual presence of personnel and equipment less than 0.6 mile from a known brown pelican and cormorant roost (the Boathouse breakwater), could cause a temporary dispersal of pelicans and cormorants from the area, at least until the end of the construction phase. This displacement would be temporary, as these birds would be expected to return. Birds displaced from the Boathouse breakwater during construction would have to seek alternate roost sites on offshore rocks in the Point Pedernales and Rocky Point areas or on the sandy beach near the mouth of the Santa Ynez River. Temporary loss of the Boathouse area as a roosting area of brown pelicans would be a localized, short-term, and insignificant impact.

Operations

Release of spilled propellant into the coastal environment could result in adverse impacts, but is not expected to occur because of the presence of spill containment areas within the boundaries of the launch complex. A launch-or accident-related ground cloud may affect marine birds in the vicinity of the launch site. However, because this impact would be localized and short-term, it would be insignificant. Localized, short-term impacts to marine birds could occur in the unlikely event of a worst-case flight failure and failure of the vehicle destruct system. The extent of this impact would be dependent on the amount of propellant released, the depth of the water column, and on the biological significance of the area of impact (Engineering Science and Sea World Research Institute 1988).

Vina Terrace

Construction

Construction of the proposed action at Vina Terrace would result in impacts to marine birds less than those described for the proposed Cypress Ridge site. Impacts to marine birds during the construction phase are expected to be less than those described for Boathouse Flats because the Vina Terrace site is located further from the nearshore littoral habitats which are utilized by marine

birds for foraging and roosting. If the proposed action were built at the Vina Terrace site, increased noise and human intrusions during construction are expected to have an insignificant affect on marine biota in the Boathouse area.

Operations

Impacts to marine birds are expected to be the same as those described for the Cypress Ridge site.

4.4.3.2 Marine Mammals

Cypress Ridge

Construction

The construction phase primarily would involve potential impacts that are temporary. These impacts may affect specially protected marine mammals, as well as those not covered under state or federal endangered species legislation (see Table B.11). Logistical activities that support construction could impact nearshore marine mammal populations. If the ocean is utilized as a route for construction supplies, adverse impacts could result from vessel movements and/or potential small fuel spills. These events could interfere with normal use by marine mammals, which may include harbor seals and, occasionally, California sea lions, which use the rocks immediately offshore of the breakwater, and sea otters and gray whales, which may pass through the immediate areas as seasonal and other parameters dictate.

Operations

Two phases of operation may be delineated relative to potential impacts to marine mammal populations. Activities before or after launches may involve movements of materials and supplies by ship or barge via the External Tank Landing Facility. This activity may prove disruptive to those marine mammal species using the nearshore (i.e., harbor seals, sea otters). In addition, the shoreward movement of fuels and chemicals brings up the consideration of spills.

Activities during launches would have a wider impact, primarily noise generated by the launch vehicle. Noise would be of two types: (1) that generated by the rockets at the launch pad for a few moments during liftoff and ascent, and (2) that created by sonic boom once the vehicle has achieved supersonic speed down range. Noise of the first type may create a startle response and stampede to the water by pinnipeds hauled out along the shore in the Cypress Ridge area.

The effect of exhaust gas emission (CO, NO_x, Al_2O_3, HCl) to pinnipeds or sea otters on or near the shoreline would depend in part on prevailing winds and rate of dissipation of exhaust gases. However, analyses of the effect of exhaust emissions done for the Titan II and Titan IV programs indicate no significant impact to marine biota (Engineering Science and Sea World Research Institute 1988).

There is the possibility for an early inflight termination and subsequent activation of the vehicle destruct system. Most of the propellant that would be released would ignite and burn before reaching the water. In the unlikely event of an inflight failure, coupled with a failure of the vehicle destruct system, the possibility exists that some liquid propellant might enter the ocean. The magnitude of the impact would depend on the amount of propellant released, the depth of the water column, and the biological significance of the impact area. Localized, short-term impacts to water quality and marine biota would likely result.

SLC-6

Impacts from project construction and operations would be the same as those described for the Cypress Ridge site.

Boathouse Flats

Should Boathouse Flats become the selected alternative, serious consideration should be given to the use of the shoreline immediately fronting the site by harbor seals since there is a possibility they may abandon the area either temporarily or permanently. Previous construction activities in areas where harbor seals haul out have given mixed results. For example, the pier near Carpinteria, California, was built through a haulout used by the seals and currently supports a continual level of activity by the oil industry. However, the animals have accommodated and persist in using the shore. Alternatively, the entrance of the Goleta Slough, about 20 miles west, was used by numbers of harbor seals 50 years ago. Subsequently, a freeway was built over it, a beach park was developed around its entrance, and the animals essentially ceased using the area.

If the Boathouse Flats site were chosen, there could be impacts to the harbor seals, related to cliff-side activities. Generally, these pinnipeds are easily spooked by as little stimulus as a single person standing in full view on a bluff top.

The potential effect of exhaust gas emissions would be greatest at this site, since it is closest to the shore and known harbor seal haulouts.

The occurrence of a launch abort or failure could have some local impact to marine mammals in the path of falling debris or incomplete oxidized propellant. Such impact, although potentially significant to involved animals, would be short-term (Engineering Science and Sea World Research Institute 1988).

Vina Terrace

Due to the relative distance of the Vina Terrace site from the shore, construction-related impacts to marine mammals are not anticipated. Operations impacts would be comparable to those described for the Cypress Ridge site.

4.4.3.3 Marine Turtles

The area affected by the proposed action does not appear to be used by significant numbers of marine turtles. The nearest breeding areas and nesting sites are along the coast of Mexico, so considerations given to interruptions of the reproductive cycle by virtue of SLC-7 project activities and launches would be inconsequential. In general, no impacts from the project are likely to significantly affect these marine turtles.

4.4.4 CUMULATIVE IMPACTS

Cumulative impacts to wildlife would occur from implementation of the proposed project in combination with other existing and proposed projects on South VAFB, primarily as a result of utilizing one of the three undeveloped sites. The cumulative effect to terrestrial and marine wildlife from an additional launch facility is expected to be regionally insignificant, although the project, combined with others on South VAFB, would act to further reduce and fragment undisturbed local wildlife habitats and wildlife movement corridors. To the extent that SLC-7 results in additional launches from South VAFB, there would be additional potential disruptions to wildlife behavior as a result of sonic booms. Also, if SLC-7 were built at one of the undeveloped sites east of Rocky Point, industrial/military development would be extended further south and east into an area of VAFB which presently is undeveloped. Such impacts would not occur if the project were implemented at SLC-6.

The proposed action at one of the three undeveloped sites would contribute to incremental losses of potential foraging habitat for peregrine falcons and a suite of other regionally rare or declining raptors on South VAFB. The lost habitat is not expected to have a significant effect on any of these species nor on the potential for successful reestablishment and population expansion of the peregrine falcon within the study region. Impacts to other regionally rare and declining wildlife species known or suspected to occur in the project area are not expected to be increased as a result of the proposed action.

4.4.5 MITIGATION MEASURES

4.4.5.1 Cypress Ridge

To help mitigate impacts associated with loss of wildlife habitat, a construction and restoration plan would be formulated and implemented. Such a plan would provide for site-specific grading and erosion control, site restoration, and revegetation. Also, as appropriate, an environmental monitor would be present during clearing and grading activities. Offsite activity by project-related construction and operations personnel would be controlled, and regulations prohibiting smoking in fire hazard areas would be established and strictly enforced.

A qualified biologist would be employed, as necessary, during the construction period to periodically inspect construction activities. Workers would be restricted from unauthorized visits to areas of sensitive offsite wildlife resources such as harbor seal hauling grounds, and marine bird roost sites and nesting colonies.

During project construction and operations, small fuel spills of petroleum products into the sea could occur if the External Tank Landing Facility should become a major avenue for delivery of equipment/material and supplies. Proper cleanup equipment would be at hand to contain and remove spilled substances. Procedures would be utilized to minimize the opportunity for spills. Further, containers for fuel storage and use would be required to be kept or constructed within suitable secondary containment structures. Employees would be restricted from interfering with wildlife.

In addition, a monitoring program with an emphasis on listed species would be developed and implemented to assess impacts to wildlife from noise and air emissions. This program would specify and implement reporting procedures to track the progress of mitigation measures.

4.4.5.2 SLC-6

Mitigations identified would be as described for the Cypress Ridge site except that no restoration plan would be developed. No additional mitigation measures are proposed.

4.4.5.3 Boathouse Flats

Mitigations identified would be as described for the Cypress Ridge site. No additional mitigation measures are proposed.

4.4.5.4 Vina Terrace

Mitigations identified would be as described for the Cypress Ridge site. No additional mitigation measures are proposed.

4.5 AIR QUALITY AND METEOROLOGY

This section addresses potential impacts to air quality resulting from construction and operation of the proposed project. During construction, fugitive dust and vehicle exhaust emissions would be generated. During operations, pollutants generated would include small amounts of fuel vapors and combustion products of vapor incinerators, flare stacks, and emergency power generators. During launch, emissions would be associated with oxidation of various propellants, including HCl, Al_2O_3, CO, and NO_X.

Impacts would be considered significant if they were to result in:

- Violation of an ambient air quality standard.
- Contribution to an existing or projected air quality violation.
- Exposure of sensitive receptors to substantial pollutant concentration(s).

4.5.1 REGIONAL IMPACTS

The overall impact to air quality resulting from construction and operation of the proposed project is anticipated to be localized and not pose the potential for significant impact to regional air quality in Santa Barbara County. Recent and historic studies indicate that VAFB contributes one to two percent to recorded regional emissions (US DOT 1988).

The potential exists for regional dispersal of nitrogen oxides and other contaminants prior to and during launch of the Titan IV/Centaur. However, studies performed for the Titan IV/NUS at SLC-4 East indicate that the short duration and intermittent nature of launch-related activities would not result in significant effects to regional air quality (USAF 1988b).

Air pollutant emissions from VAFB for the year 1986 were summarized in Section 3.5.1.3 and Table 3.5.1. Table 4.5.1 (SLC-7 Operational Emissions) presents a preliminary estimate of air contaminant emissions anticipated from normal launch support activities at the rate of three launches per year. Table 4.5.2 (Comparison of SLC-7 and VAFB Annual Emissions) compares the magnitude of operational emissions anticipated to result from implementation of the proposed action with total VAFB emissions. This table demonstrates that, at most, SLC-7 operational emissions are expected to be one percent of current annual VAFB emissions. The pollution control technology shown in Table 4.5.1 and discussed in the text represents a reasonable worst-case

TABLE 4.5.1

SLC-7 OPERATIONAL EMISSIONS

LAUNCHES PER YEAR - 3

1) PROPANE COMBUSTION-RELATED SOURCES:

SOURCE	HRS/ LAUNCH	LB/HR PROPANE	MM-BTU/ HR	GALLONS/ HR PROPANE	NO_x			SO_2			CO			PM			ROC		
					LB/M-GAL	LB/HR	LB/YR	LB/M-GAL	LB/HR	LB/YR	LB/M-GAL	LB/HR	LB/YR	LB/M-GAL	LB/HR	LB/YR	LB/M-GAL	LB/HR	LB/YR
Operations Support Building	N/A	16	0.34	3.9	12.4	0.05	423	0.014	0.00	0	3.1	0.01	106	0.44	0.00	15	0.25	0.00	9
Guard House	N/A	6	0.13	1.5	12.4	0.02	158	0.014	0.00	0	3.1	0.00	40	0.44	0.00	6	0.25	0.00	3
Launch Service Structure	1680	242	5.20	58.9	12.4	0.73	3678	0.014	0.00	4	3.1	0.18	920	0.44	0.03	131	0.25	0.01	74
H2 Flare (booster)	300	10.2	0.22	2.5	12.4	0.03	28	0.014	0.00	0	3.1	0.01	7	0.44	0.00	1	0.25	0.00	1
H2 Flare (payload)	300	10.2	0.22	2.5	12.4	0.03	28	0.014	0.00	0	3.1	0.01	7	0.44	0.00	1	0.25	0.00	1
Fuel Vapor Incinerator (1)	45	3080	66.17	749	12.4	9.29	1254	0.014	0.01	1	3.1	2.32	313	0.44	0.33	44	0.25	0.19	25
Oxidizer Vapor Scrubber (1)	45	0	0.00	0.0	12.4	31.16	4207	0.014	0.00	0	3.1	0.00	0	0.44	0.00	0	0.25	0.00	0
TOTALS		3364.4		818.3		41.31	9776		0.01	5		2.53	1393		0.36	198		0.20	113

2) LAUNCH ESSENTIAL POWER GENERATION

SOURCE	HRS/ MONTH	MONTH/ YEAR	kWh	NO_x			SO_2			CO			PM_{10}			ROC		
				LB/kWh	LB/HR	LB/YR	LB/kWh	LB/HR	LB/YR	LB/kWh	LB/HR	LB/YR	LB/kWh	LB/HR	LB/YR	LB/kWh	LB/HR	LB/YR
Diesel Engine	2	12	500	0.0375	18.7	449	0.0028	1.4	34	0.009	4.5	108	0.003	1.5	36	0.0033	1.65	40

3) SHARED USE FACILITY EMISSIONS

SOURCE	FAIRING PROCESSINGS PER YEAR	NO_x		SO_2		CO		PM_{10}		ROC	
		LB/HR	LB/YR	LB/HR	LB/YR	LB/HR	LB/YR	LB/HR	LB/YR	LB/HR	LB/YR
Bldg. 8337 Payload Fairing Spray Booths	10	0	0	0	0	0	0	0	0	4.75	249

4) NET EMISSIONS INCREASE (PRELIMINARY CALCULATION)

SOURCE	NO_x		SO_2		CO		PM_{10}		ROC	
	LB/HR	LB/YR	LB/HR	LB/YR	LB/HR	LB/YR	LB/HR	LB/YR	LB/HR	LB/YR
Total of All Emission Sources	60.01	10,224	1.41	40	7.03	1,501	1.86	234	6.60	402

(1) USAF is presently engaged in studying alternative methods for control of fuel and oxidizer vapor emissions. Preliminary analyses have determined that the worst-case 1-hour average emissions would result from usage of a fuel vapor incinerator and an oxidizer vapor scrubber.

Source: TRC Environmental Consultants 1988.

TABLE 4.5.2

COMPARISON OF SLC-7 AND VAFB ANNUAL EMISSIONS

SOURCE	NO_x (tons/year)	SO_2 (tons/year)	CO (tons/year)	PM_{10} (tons/year)	ROC[1] (tons/year)
VAFB[2]	511.2	149.0	1,545.0	101.1	468.5
SLC-7	5.1	0.02	0.75	0.1	0.2
TOTAL	516.3	149.02	1,545.75	101.2	468.7

(1) Value shown is for Reactive Organic Compounds.

(2) From 1986 Vandenberg Air Force Base Emissions Inventory (USAF 1988c).

assumption. The selection of pollution control technologies would be made in concert with the ATC application process. The selected controls are expected to be at least as efficient in controlling emissions as those presented in this discussion.

4.5.2 LOCAL IMPACTS

The installation and operation of the proposed project at VAFB could result in localized air resources impacts as a result of emissions from: (1) facility construction, (2) pre-launch and post-launch processing, (3) Titan IV/Centaur launch, and (4) vehicle failure.

4.5.2.1 Cypress Ridge

Facility Construction

Construction of SLC-7 and associated support facilities at the proposed Cypress Ridge site would involve ground-disturbing activities such as excavation, filling, and grading, which involve the use of earth-moving equipment and the generation of fugitive dust. Pollutants generated from construction of associated space launch support facilities are fugitive dust and exhaust emissions such as carbon monoxide, nitrogen oxides, and reactive hydrocarbons.

Fugitive dust generated from ground disturbing activities is estimated based on emission factors published by the EPA in AP-42, "Compilation of Air Pollutant Emission Factors." Present estimates anticipate that approximately 500 tons of particulate material (uncontrolled emissions) could be generated during a "worst-case" year of construction activity. The SLC-7 construction period is currently expected to last about four years. An effective watering program (twice daily watering with complete coverage) is estimated to reduce dust emissions by up to 50 percent (US EPA 1972). Ground disturbing activities would be conducted so as to maintain opacity at or below the limits in Rule 302, Visible Emissions, specified by the SBCAPCD (n.d.).

Exhaust emissions from construction equipment have been estimated based on emission factors published in EPA AP-42. Table 4.5.3 (SLC-7 Estimated Construction Equipment Emissions at the Cypress Ridge Site) summarizes these estimates based on a worst-case construction year. The table also shows the types and quantities of equipment to be used. Equipment estimates were based on the present construction schedule shown in Figure 2.1.9.

TABLE 4.5.3

SLC-7 ESTIMATED CONSTRUCTION EQUIPMENT EMISSIONS AT THE CYPRESS RIDGE SITE

EQUIPMENT		EQUIPMENT EMISSION FACTOR[1] (pounds/hour-unit)					EQUIPMENT EMISSIONS (pounds/hour)				
TYPE	QUANTITIES	CO	HC	NO_x	SO_x	TSP	CO	HC	NO_x	SO_2	TSP
Dozer	5	0.3	0.1	1.3	0.1	0.1	1.7	0.6	6.3	0.7	0.6
Scraper	18	1.3	0.3	3.8	0.5	0.4	22.6	5.1	69.1	8.3	7.3
Crane	3	0.7	0.2	1.7	0.1	0.1	2.0	0.5	5.1	0.4	0.4
Loader	15	0.6	0.3	1.9	0.2	0.2	8.6	3.8	28.4	2.7	2.6
Grader	45	0.2	0.0	0.7	0.1	0.1	0.8	0.2	3.6	0.4	0.3
Water Truck	4	1.8	0.2	4.2	0.5	0.3	7.2	0.8	16.7	1.8	1.0
Oiler Truck	1	1.8	0.2	4.2	0.5	0.3	1.8	0.2	4.2	0.5	0.3
Haul Truck	50	1.8	0.2	4.2	0.5	0.3	89.7	9.6	208.3	22.7	12.8
Compactor	17	0.3	0.1	0.9	0.1	0.1	5.2	1.1	14.7	1.1	0.9
Paver	1	0.3	0.1	0.9	0.1	0.1	0.3	0.1	0.9	0.1	0.1
Vibrating Drum	1	0.7	0.2	1.7	0.1	0.1	0.7	0.2	1.7	0.1	0.1
			Total Combined Emissions (pounds/hour)				140.6	22.2	632.0	38.8	26.4
			Total Combined Emissions (pounds/day)				1,124.3	176.0	5,056.1	311.4	210.3
			Total Combined Emissions (tons/year)				146.0	22.9	656.8	40.5	27.3

[1] Reference: U.S. EPA 1985.

Project construction emissions are temporary and site-specific, so air quality impacts are anticipated to be short-term and localized. The magnitude and distribution of these emissions will be quantitatively addressed in the Authority to Construct (ATC) procedure.

Included in the analysis would be emissions from the concrete batch plant used during project construction. The construction contractor operating the batch plant would be required to obtain any other required permits.

Pre-launch and Post-launch Processing

Fuel propellant and oxidizer for a Titan IV/Centaur launch would be delivered and stored at the launch site in Ready Storage Vessels (RSV). Vapor from the storage and transfer of propellant before and after launch (to RSV from delivery trailer truck, from RSV to Stage I and Stage II fuel tanks, and during post-launch purging of RSV and transfer system) would be vented to either a fuel vapor incinerator system (FVIS) fired with propane or natural gas or a fuel vapor scrubber system (FVSS). The FVIS or FVSS would be used to oxidize the propellant vapor prior to release to the atmosphere. Oxidizer vapor from storage and transfer operations would be vented either to a scrubber or to a vapor incineration system fired by propane or natural gas.

Small releases of fuel and oxidizer could occur as a result of scheduled post-launch maintenance, when fuel and oxidizer filters are replaced. These releases occur only after the propellant lines have been purged with nitrogen gas to reduce emissions to the lowest practicable level. There is no way to completely eliminate them, as the system must be opened to change the filters. The releases are not expected to result in a significant impact to the environment.

No uncontrolled venting of vapors is expected to result from overfilling or over pressurizing the RSV and the Stage I and II tanks. Redundant flow meters and redundant automatic shutdown devices on the propellant loading system prevent overfilling, while automatic pressure monitoring devices on the tanks and feed system prevent over-pressurization. In the event of an emergency, fuel and/or oxidizer may vent directly to the atmosphere. Situations that might be considered emergency would be rupture of the propellant loading system during fueling operations or rupture of the fuel or oxidizer vehicle propellant tanks while on the launch pad.

Combustion products consisting of carbon monoxide (CO), sulfur oxides (SO_x), nitrogen oxides (NO_x) and hydrocarbons (HC) are released to the atmosphere through vapor incinerator vent stacks (see Table 4.5.1). Should the USAF opt to utilize a scrubber rather than an incinerator for control of oxidizer vapor emissions, operation of the oxidizer vapor scrubber would result only in emissions of NO_x.

In addition to fuel and oxidizer vapor control systems, preliminary design calls for flare stacks to incinerate vapors escaping from liquid hydrogen handling operations. Such flares would consist of a pilot flame which would be fired by propane or natural gas. Emissions from incineration of hydrogen vapors would consist of CO, SO_x, NO_x, and HC.

Other sources of pre- and post-launch air contaminant emissions include an emergency power generator, boilers, and heating and air conditioning systems. Each of these devices would emit combustion products consisting of CO, SO_x, NO_x, and HC.

Impacts to ambient air quality resulting from each of the above sources are considered insignificant because emission levels are low, the occurrence of emissions is infrequent, and operations are intermittent. The magnitude and distribution of these emission sources have been quantitatively addressed in the ATC application. This analysis showed that the maximum one-hour NO_2 concentration resulting from the addition of the SLC-7 sources to the existing environment would be 354 $\mu g/m^3$. The California Ambient Air Quality Standard (CAAQS) for one-hour NO_2 concentrations is 470 $\mu g/m^3$. The increase in emissions due to the addition of SLC-7 would not be significant for NO_2, as the ambient air quality standard would not be violated. The only emission modeled was NO_2, as this represented the highest emission rate generated at the site, as well as the greatest emission rate relative to the CAAQS. Therefore, because emissions of NO_2 were determined to be insignificant, emissions of other pollutants also would be insignificant.

Launch Emissions

Launch operations constitute the greatest source of uncontrollable emissions. Titan IV/Centaur launch emissions are associated with the oxidation of propellants during various stages of the launch cycle. The combustion products are distributed along the trajectory of the launch, from liftoff to Stage II shutdown.

Studies performed in support of similar Titan IV launch activities at SLC-4 (USAF 1988b) determined that the primary pollution products of concern from a Titan launch are HCl, Al_2O_3, CO, and NO_x from combustion of the SRMUs, and CO and NO_x from combustion of hypergolic fuels. Emissions around the launch area during liftoff would be limited to HCl, Al_2O_3, CO, and NO_x, as only the SRMUs fire during liftoff, as shown in Table 4.5.4 (Titan IV SRMU Emissions). At a down-range distance of 25 miles and an altitude of 25 miles, the core vehicle main engines start to fire as the SRMUs complete their burns. Standard VAFB launch operational control procedures (discussed in Section 4.5.4.1) would result in minimum migration of pollutants into inland uncontrolled areas near VAFB.

Emissions from Vehicle Failures

The emission of air pollutants can result from vehicle failures. Potential accidents include vehicle destruction on the pad, in-flight failure, and command vehicle destruction. In the event of liquid propellant tank rupture and subsequent activation of the vehicle destruct system, some of the propellant would immediately ignite and burn, due to its hypergolic nature.

The air pollutants generated from a vehicle failure would be chemically similar to those produced during a normal launch, but in undetermined quantities and concentrations. Resultant ambient NO_x concentrations would depend on the type of accident. Except during a launch pad accident, NO_x would be generated throughout the flight path, and some dilution would occur prior to reaching ground level. Launch pad accidents, however, might increase ambient NO_x concentrations, as generation would occur at or near ground level. Standard VAFB launch operational control procedures (discussed in Section 4.5.4.1) would result in minimum migration of pollutants into inland uncontrolled areas near VAFB. This issue is further addressed under Health and Safety (Sections 3.11 and 4.11).

Operational Control Procedures

Operational control procedures involve making a decision whether or not to launch based on predicted meteorological conditions. This provides a means to minimize impacts to onshore air quality and to human, plant, and animal life. The climatology and geography of VAFB require special consideration prior to a decision to launch. At VAFB, the prevailing wind direction is onshore, and the distance from the launch site to the nearest uncontrolled inland area is four miles.

TABLE 4.5.4

TITAN IV SRMU EMISSIONS

Pollutant	Total Emissions for Complete Burn (tons)[1]	Emissions Under 5,000 foot Level (tons)[2]
Al_2O_3	244	27
HCl	146	41
NO_2	12	38
CO	38	1.0

(1) Source: USAF 1987c.

(2) Source: USAF 1988b.

Moreover, a subsidence inversion layer persists over the area most of the day, thereby limiting dispersion. These meteorological conditions can cause the transport of air pollutants from launch operations into uncontrolled areas, with subsequent degradation of air quality.

Because of these constraints, a Toxic Hazard Corridor (THC) forecast is prepared to assist operational personnel in determining favorable launch conditions. If the THC encompasses unprotected or uncontrolled areas, the launch is postponed until such time as meteorological conditions are more favorable. The forecast is prepared by the USAF, using information gathered by the Weather Information Network and Display System (WINDS). The WINDS program consists of a network of meteorological observation towers at representative locations throughout VAFB (including a new tower at the proposed Cypress Ridge site), ranging in height from 6 to 300 feet. The meteorological data gathered by these stations are transmitted to a central receiving station, processed by a computer, and presented on a scaled map display panel. Weather parameters observed at each station are displayed at discrete intervals. In addition, these data are used in meteorological prediction programs.

The THC forecast is continuously monitored and modified, when necessary. The actual THC forecast contains the meteorological data from WINDS (wind speed and direction, temperature changes, and wind direction variability), an arc that would enclose a toxic spill, and the downwind distance that would be the limit of hazardous vapor. The forecast is valid for no more than two hours.

4.5.2.2 SLC-6

Facility Construction

Modification of SLC-6 for the Titan IV/Centaur would involve large amounts of concrete removal from the existing launch mount and exhaust duct structure. The total amount of concrete and steel to be removed has been estimated at 1,800 cubic yards and 1,200 tons, respectively. This concrete and rebar would be removed by jackhammer and cutting torch. The concrete is held together with rebar and would not be expected to be easily loosened. It is estimated that four tons of concrete dust would be generated by demolition. No new grading would be required at the facility, thus eliminating dust generated by this activity. Site preparation activity for SLC-6 would be minimal, compared to implementation of the proposed action at one of the undeveloped sites. Therefore, selection of the SLC-6 alternative would avoid most of the construction-related air quality impacts associated with the undeveloped sites.

Project construction emissions are temporary, so impacts to air quality are anticipated to be short-term and localized. Because the emissions would be short-term and localized, they are not expected to have a significant impact on the environment.

Operational Emissions

Operational emissions from use of the SLC-6 alternative site would be similar to those at the proposed Cypress Ridge site and would also be expected to have an insignificant impact on the local environment.

4.5.2.3 Boathouse Flats

Localized air resource impacts associated with construction and operation of SLC-7 facilities at the Boathouse Flats alternative site are similar to those discussed for the Cypress Ridge site.

4.5.2.4 Vina Terrace

Localized air resources impacts associated with construction and operation of SLC-7 facilities at the Vina Terrace alternative site are similar to those discussed for the Cypress Ridge site.

4.5.3 CUMULATIVE IMPACTS

For the purpose of assessing cumulative impacts pertaining to air resources (in concurrence with SBCAPCD), the proposed project operational emissions have been added to existing emissions from the STS power plant and three offshore oil platforms (Harvest, Hermosa, and Hidalgo). If SLC-6 were to become operational for the Space Shuttle or some other program, it would also be included, but such occurrence is not anticipated in the foreseeable future. Implementation of the SLC-6 alternative site for the Titan IV/Centaur would preclude it as an emission source additive to the proposed action.

The emissions produced by the proposed project, the STS power plant, and the three off-shore oil platforms are shown in Table 4.5.5 (SLC-7 Cumulative Emissions). As indicated on the table, emissions of NO_x and ROC from SLC-7 would be more than those from the STS Power Plant, but less than those of the offshore oil platforms. The addition of the SLC-7 emissions to the existing mix would represent a cumulative 10 percent increase. In order to determine the potential

TABLE 4.5.5

SLC-7 CUMULATIVE EMISSIONS

SOURCE	NO_x (tons/year)	SO_2 (tons/year)	CO (tons/year)	PM_{10} (tons/year)	ROC (tons/year)
SLC-7	24.5	1.4	5.4	1.6	6.5
STS Power Plant	18.0	0.14	22.5	2.91	2.55
Offshore Oil Platforms	232.0	18.0	154.0	3.8	NA
TOTAL	274.5	19.54	181.9	8.31	9.05

NA = Not Available

Source: TRC Environmental Consultants 1988.

significance of the addition of SLC-7 emissions, results of the preliminary ATC were evaluated. This evaluation showed the greatest emission relative to its CAAQS to be NO_2, with a maximum one-hour concentration of 354 $\mu g/m^3$, compared to the standard of 470 $\mu g/m^3$. Because the addition of SLC-7 emissions to those of the STS power plant and offshore oil platforms would not result in violation of the CAAQS for NO_2, the cumulative impact would not be considered significant. Other pollutants emitted from SLC-7 also would have insignificant effects. The emission rates of the other SLC-7 pollutants (CO, SO_x, PM_{10}, and ROC) would be lower relative to their CAAQS than those for NO_2. Therefore, their addition to concentrations evaluated in the cumulative analysis would not be significant.

4.5.4 MITIGATION MEASURES

4.5.4.1 Cypress Ridge

Mitigation measures to minimize impacts to local air quality from ground disturbing activities during construction at Cypress Ridge include watering, as necessary, to eliminate visible particulate emissions. If necessary, these activities would be modified in order to maintain recommended opacity limits as established by SBCAPCD. As set forth in Rule 302, Visible Emissions, B, "A person shall not discharge into the atmosphere from a single source of emission any air contaminants for a period or periods aggregating more than three minutes in any one hour which is: (1) as dark or darker in shade as that designated as No. 1 on the Ringelmann Chart, as published by the United States Bureau of Mines..." Emissions from construction equipment and vehicle exhaust would be kept to a minimum by proper engine maintenance. During the construction phase of the proposed project, if required by SBCAPCD, equipment operations may be curtailed in order to reduce emissions.

Mitigation measures to minimize impacts from Titan IV/Centaur launches are incorporated into the program as process and operational controls. Process control involves the use of air pollution control equipment, while operational control is discretionary and based on actual and predicted conditions. The air pollution control devices would include either an FVIS or FVSS and an oxidizer vapor control system (either incinerator or scrubber). The fuel vapor and oxidizer vapor control systems, and other devices emitting air contaminants would be certified and permitted by the SBCAPCD during review of the application for the ATC and Permit To Operate (PTO).

4.5.4.2 SLC-6

Mitigation measures to minimize both construction and operational air quality impacts at the SLC-6 alternative site are the same as those described for the Cypress Ridge site.

4.5.4.3 Boathouse Flats

Mitigation measures to minimize both construction and operational air quality impacts at the Boathouse Flats alternative site are the same as those described for the Cypress Ridge site.

4.5.4.4 Vina Terrace

Mitigation measures to minimize both construction and operational air quality impacts at the Vina Terrace alternative site are the same as those described for the Cypress Ridge site.

4.6 WASTE MANAGEMENT

This section addresses potential impacts related to project generation of domestic, industrial, and hazardous wastes. For the three undeveloped sites, construction activities would result in the generation of relatively small quantities of domestic sewage, scrap construction materials, and industrial fluids, such as waste oil. For the SLC-6 alternative, there would be relatively large amounts of scrap concrete and steel resulting from site demolition activities. Other construction wastes would be comparable for the four sites. Project operations would be comparable at the four potential sites and result in the generation of domestic sludge, industrial solid waste and wastewater, and hazardous wastes. The latter would be generated primarily during vehicle preparation activities and consist of materials such as water contaminated by hypergolic fuel, various solvents and primers, and contaminated clothing.

In the following discussion, regional impacts relative to waste management have been addressed for North VAFB and the nearby Lompoc and Santa Maria Valleys. Local impacts have been addressed for South VAFB, including the proposed Cypress Ridge site and the three alternative sites. This discussion centers on impacts to the regional and local environments that would result from addition of waste products of the proposed project to other, ongoing activities at VAFB. The three categories of wastes identified in Section 3.6 are addressed here: (1) domestic, (2) industrial, and (3) hazardous. Wastes generated by construction are addressed separately from those generated by project operations.

Impacts are considered to be significant if they would result in:

- Exceeding published federal, state, or local standards relating to waste control.
- A substantial increase in domestic wastes processed at publicly owned treatment works (POTW).
- A substantial increase in industrial wastes processed at either VAFB or Lompoc Class II facilities.
- A substantial increase in the amount of hazardous waste to be disposed of at approved Class I disposal facilities.

4.6.1 REGIONAL IMPACTS

Most regional impacts would be the same for the proposed and alternative sites. However, demolition of the SLC-6 launch mount and the subsequent disposal of rebar and concrete, as well

as removal and disposal of the hypergolic propellant systems at SLC-6, would result in regional impacts to industrial disposal facilities. These are addressed under Construction in Section 4.6.2.2.

4.6.1.1 Domestic Waste

Construction

Waste generated by chemical toilets at the construction site would be disposed of at the Santa Maria POTW. The amount of waste generated would be small compared to the facility's overall capacity of 6.5 million gallons per day (gpd) or about 2.4 billion gallons per year. Therefore, no significant regional impacts are expected.

Operations

During operations, domestic waste would be treated at the proposed project site with a package sanitary sewage treatment plant. The digested sludge from the sedimentation tanks associated with the plant would be pumped an average of once every two years. This sludge would then be taken to the Santa Maria POTW for disposal. The plant currently operates at 5.7 million gpd or 2.1 billion gallons per year. The sewage to be added from proposed project operations would amount to 1,000 gallons per pumping, or 500 gallons per year. This incremental increase over the existing average daily flow through the plant would not significantly impact the Santa Maria facility.

4.6.1.2 Industrial Waste

Construction

Industrial wastes generated during construction at one of the three undeveloped sites would consist of materials such as solid pieces of metal, concrete, lumber, and various other building materials. These materials would be disposed of at an approved Class III or Class II landfill. These additional materials would, to some extent, reduce the overall life of the landfills, but are not expected to result in significant impacts.

Industrial wastes generated during construction at SLC-6 would consist of approximately 1,800 cubic yards of concrete and 1,200 tons of steel, in addition to various other building materials.

These wastes would be disposed of at an approved Class III or Class II landfill. They are not expected to significantly affect the landfill where they are disposed.

Operations

Industrial wastes generated during operations would consist of small amounts of solid wastes and large amounts of liquid wastes. The solid wastes would be disposed of either at the North VAFB Class III landfill or the Lompoc Class II landfill. The addition of these materials would not significantly impact the region but could reduce the overall life of the landfills. The liquid industrial wastes would be treated at facilities on South VAFB according to Regional Water Quality Control Board (RWQCB) requirements and, therefore, would not adversely affect the regional environment.

4.6.1.3 Hazardous Waste

Construction

Hazardous wastes generated during construction would consist of materials such as waste oils, hydraulic fluids, cleaning fluids, cutting fluids, and waste antifreeze. These materials would be containerized and properly disposed of by the individual contractors. The hazardous waste generated during construction would be either disposed of at a Class I landfill or recycled. Disposal of the waste at the landfill would reduce the overall life of the landfill, but not significantly. Recycling would lead to less waste being sent to the landfill, thus reducing overall impacts to the landfill.

Operations

Hazardous wastes produced during operations would include materials such as water contaminated by hypergolic fuel, various solvents and cleaners, paints and primers, cleaning rags, and contaminated clothing. Hazardous wastes from the proposed Titan IV/Centaur program would be produced on North VAFB in Buildings 8337 and 8401, as well as at other, indirectly linked, maintenance facilities. The current levels of wastes generated in these buildings by the Titan II and Titan IV programs at SLC-4 and the wastes to be generated as a result of the proposed program are shown in Figure 4.6.1 (North VAFB Hazardous Wastes, Titan II, IV, and SLC-7 Programs). These wastes are typically generated in preparing the Titan IV core vehicle and

HAZARDOUS WASTE DESCRIPTION	EPA WASTE NUMBER	QUANTITY OF WASTE GENERATED BY TITAN PROGRAM ON NORTH VAFB (TONS/YEAR)	
		CURRENT	SLC-7
Ignitables (liquid and/or solid)	D001	2.5	2.1
Corrosives (acid or base liquids and/or solids)	D002	0.4	0.7
Reactives (solid and/or liquid)	D003	0	0
Halogenated Solvents (toxic poisons)	F001	3.8	3.3
Halogenated Solvents (toxic irritating poisons)	F002	0.8	0.7
Non-Halogenated Solvents (ignitable poisons)	F003	0.93	0.81
Contains Misc. EP Toxics, Listed Acute Hazardous Wastes, Listed Toxic Wastes, and California Listed Wastes	Other	27.2	23.3
TOTAL *		35.6	30.9

*Rounded to the nearest tenth.

Source: USAF 1988b.

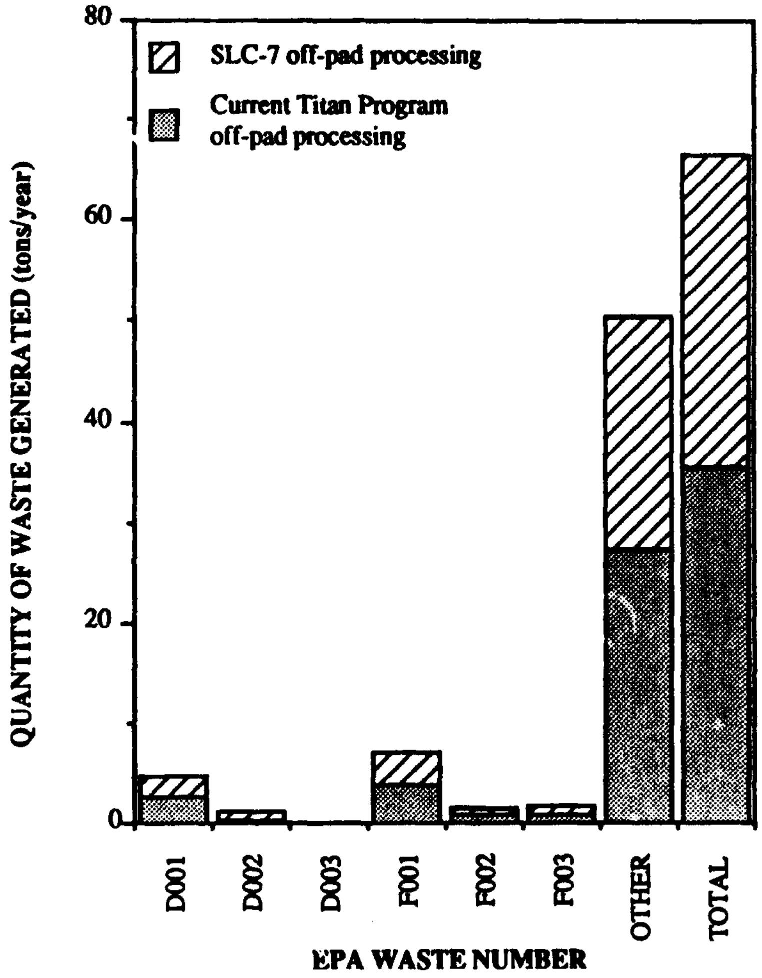


FIGURE 4.6.1

NORTH VAFB HAZARDOUS WASTES TITAN II, IV, AND SLC-7 PROGRAMS

payload fairings before they are moved to the launch pad. The majority of the wastes include solvents, paints, and paint preparation materials. As with wastes from other programs, wastes associated with the proposed action would be containerized, sent to the nearest VAFB collection accumulation point (CAP), then transferred to the North VAFB EPA hazardous waste storage facility for disposal or recycle. The capacity of the EPA facility is 45,760 gallons. In 1987 the amount of hazardous wastes stored in the facility averaged 15,400 gallons, representing an average facility utilization of 34 percent. Utilization of the EPA facility is expected to increase during SLC-7 operations. Wastes being transferred to a Class I landfill also would increase during operations and could lead to a decrease in the life of the landfill. Impacts to the life of the landfill could be reduced by recycling. Waste minimization may also lead to overall cost reductions for the project and conservation of natural resources (see Section 3.6). Impacts to the region are expected to be minimal.

4.6.2 LOCAL IMPACTS

4.6.2.1 Cypress Ridge

Domestic Waste

Construction

Domestic waste generated during construction would be treated by chemical toilets provided by the contractor. One toilet would be needed for every 40 construction workers. No significant impacts are anticipated, provided adherence to appropriate maintenance practices.

Operations

Domestic waste generated during operations would be treated at the SLC-7 site by a package sanitary sewage treatment plant, with effluent discharged into two evaporation/percolation ponds. As shown in Figure 2.1.3, the plant and ponds would be located south and east of the site. Prior to building the ponds, percolation tests would be performed to ensure the suitability of the soil. The RWQCB requires an investigation of the preferred location for the ponds to ensure compliance with Resolution No. 83-12. Subsequent to satisfactory percolation tests and final location of the ponds, the RWQCB may grant a permit for operation.

The facility and ponds would be designed per Resolution 83-12 to handle domestic waste for a maximum of 900 people per 24-hour day or a capacity of 36,000 gallons per day. Design requirements of the package plant would become design criteria for the SLC-7 project.

No significant impacts to the local environment are anticipated, provided adherence to design criteria of the package plant and evaporation/percolation ponds, and proper operation of the facility.

Industrial Waste

Construction

Industrial wastes generated during construction would consist of materials such as pieces of metal, concrete, lumber, and various other building materials. These wastes would be disposed of at an approved Class III or Class II landfill. The addition of these industrial wastes would shorten the life of the utilized landfill, although impacts would not be expected to be significant.

Operations

Industrial wastes generated during operations would consist of small amounts of solid waste and large amounts of liquid wastewater. The solid waste would be hauled for disposal to either the North VAFB Class III landfill or the Lompoc Class II landfill. The solid industrial waste generated would not have significant impact.

Approximately 146,000 gallons of water are used during a launch sequence. Of this amount, approximately 126,000 gallons of wastewater would be generated, 20,000 gallons of which would evaporate to form a ground cloud. This water is generated during three operations: (1) pre-launch check-out, (2) launch exhaust cooling, and (3) post-launch washdown of the flame duct, towers, and launch pad. Pre-launch check-out would use about 80,000 gallons of water. About 26,000 gallons of water would be used for launch exhaust cooling. Post-launch washdown would use about 40,000 gallons of water. These three operations would be run concurrently, with the wastewater accumulating in the flame duct wastewater retention basin.

The wastewater may contain various metallic contaminants, acidic compounds, and low levels of hypergolic fuels. The metals are compounds such as zinc, lead, and cadmium that come mainly from paint burned off during a launch. The acidic compounds in the form of HCl com from the solid rocket boosters. The wastewater would be analyzed while in the retention basin and would be classified based on the amount of metals and hypergolic fuels contained in the water. If hypergolic fuel were detected, it would be treated before disposal. A UV/ozone wastewater treatment facility would be used if available at VAFB.

High concentrations of hypergolic fuel in the wastewater would cause it to be classified as a hazardous waste. These concentrations are calculated using a formula in CCR Title 22, Chapter 30, Article II, Section 66696, Paragraph C. This formula yields hazardous waste level concentrations of 1.2 percent for hydrazine, 0.66 percent for monomethyl hydrazine, 2.44 percent for unsymmetrical dimethyl hydrazine, and 0.8 percent for Aerozine-50. Concentrations of hypergolic fuel below these levels would be considered nonhazardous and could be treated on-base without a RCRA permit. If not recycled for reuse, the wastewater could be trucked to the SLC-6 evaporation ponds after treatment to remove hypergolic fuels, if necessary. Because this wastewater would contain designated pollutants, the ponds would be upgraded to meet Class II impoundment specifications as detailed in CCR Title 23, Subchapter 15, Section 2532.

If the wastewater were classified as a hazardous waste, it would be pretreated before being taken to the evaporation ponds. In this case, the water would be transported by truck to an appropriate treatment facility. If permitted, the SLC-6 wastewater treatment plant could be used. If available at VAFB, a UV/ozone wastewater treatment facility would be used. The approximate concentration of impurities in the water after hypochlorite treatment is shown in Table 4.6.1 (Estimated Launch Wastewater Characteristics after Hypochlorite Treatment) under the heading of Concentration A. These concentrations were calculated based on measured concentrations of wastewater sampled after Titan 34D launches from SLC-4 East (USAF 1988b). The components and concentrations are such that, after treatment, the wastewater is not a hazardous waste.

At the SLC-6 wastewater treatment plant, a process used consists of two parts: (1) precipitation/filtration and (2) reverse osmosis, as shown in Figure 4.6.2 (SLC-7 Launch Wastewater Generation and Treatment Cycle). Precipitation consists of treating the water with lime, magnesium hydroxide, caustic soda, sodium sulfide, and flocculating polymers to remove heavy metals from the solution. The heavy metals precipitate out as metal hydroxides or sulfides and are thickened and removed from solution using a filter press. The produced filter cake is analyzed to determine whether it is hazardous. If determined to be hazardous, it is placed in sealed containers for transfer to the South VAFB CAP. If determined not to be hazardous, the filter cake is disposed of in an appropriate Class III landfill.

Approximately 126,000 gallons of wastewater would leave the precipitation/filtration process at a concentration of B, as shown in Figure 4.6.2. This water would have a much lower concentration of metals than that coming into the unit. If the water were to be reused, total dissolved solids, chlorides, and a few remaining metals could be removed by utilizing reverse osmosis. If not reused, the water could be sent to the evaporation ponds.

TABLE 4.6.1

ESTIMATED LAUNCH WASTEWATER CHARACTERISTICS[1] AFTER HYPOCHLORITE TREATMENT

CONTAMINANT [2]	CONCENTRATION A[3]	CONCENTRATION B[4]	CONCENTRATION C[4]	RWQCB STANDARDS
pH (units)	2-3	9.0-10	7.0	5-9
TDS	1,462	1,747	230	500
Hardness	472	NR	NR	400
Alkalinity	Ø	NR	NR	400
COD	50	50	NR	NS
TOC	1	1	<0.1	NS
Ca	200	180	6.1	80[5]
Mg	32	16	1	27[5]
K	7	NR	NR	NS
Na	400	400	88	82[5]
Chloride	1,500	1,500	75	250
Sulfate	.68	50	15	250
Nitrate	40	40	<1	45
Cd (µg/l)	200	<10	<1	10
Cr (µg/l)	100	<2	<1	50
Cu (µg/l)	500	5	<1	1,000
Fe (µg/l)	6,000	93	20	300
Pb (µg/l)	600	4	<1	50
Mn (µg/l)	400	5	<1	50
Zn (µg/l)	100,000	1,068	33	5,000
Al (µg/l)	20,000	586	117	NS
SiO_2	50	NR	NR	NR

(1) Wastes shown are products of a normal launch (i.e., no hypergolics).
(2) Concentration = mg/l except where noted.
(3) Source: USAF 1988b.
(4) Source: Fluor 1986.
(5) Typical South VAFB ground water concentrations (no standards).

NR = Not Reported NS = No standard

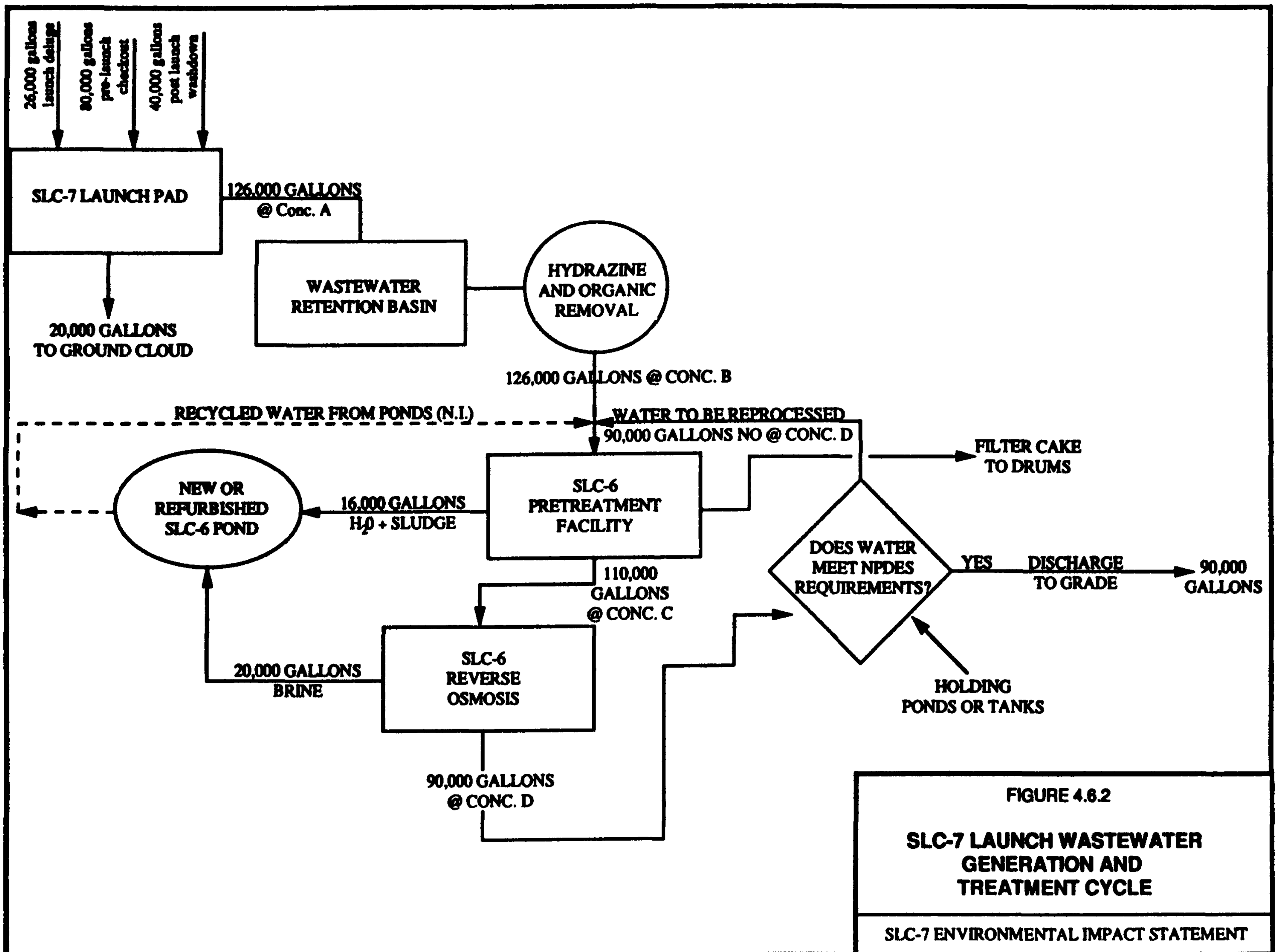


FIGURE 4.8.2

SLC-7 LAUNCH WASTEWATER GENERATION AND TREATMENT CYCLE

SLC-7 ENVIRONMENTAL IMPACT STATEMENT

After precipitation and filtration, the wastewater would flow to the reverse osmosis unit for removal of the remaining suspended solids and salts. Reverse osmosis is the process of removing water from solids and salts in solution. This is done by increasing the pressure of the solution to greater than its osmotic pressure. The water is then forced through a semi-permeable membrane where the salts are retained. The process is designed to be a minimum of 80 percent efficient in the removal of water from the solution. Current regulations regarding handling of this brine are more stringent than when the SLC-6 ponds were constructed. Therefore, the existing ponds would be upgraded prior to accepting waste brine.

The concentrate from this process is sent to the evaporation ponds as a brine. The treated water leaving the reverse osmosis facility would be sent to a storage tank. The treated water would be of concentration C, as shown in Table 4.6.1 and would be tested to see if the concentrations of solid materials had been lowered to levels that would no longer be considered in excess of safe drinking water standards. If the quality of the water were determined to be unsuitable, it could be put back through the SLC-6 wastewater treatment plant for further treatment. Once acceptable, the water could be recycled or transferred to a holding tank. The containment facility would meet the requirements of the RWQCB. If discharging the water to grade were to become a viable option, an NPDES permit would be obtained from the RWQCB.

Because regulations governing the treatment and disposal of industrial solid and liquid waste would be followed, no significant impacts to the local environment would be anticipated.

Hazardous Waste

Construction

As previously discussed, hazardous wastes generated during construction would consist of materials such as waste oils, hydraulic, cleaning, and cutting fluids, and waste antifreeze. These would be disposed of as discussed in Section 4.6.1.3. The generation and disposal of hazardous wastes during construction would not create significant impacts.

Operations

Hazardous wastes generated during operations would include materials such as water contaminated by hypergolic fuel (generated during spills or maintenance), various solvents and cleaners, paints and primers, cleaning rags, and contaminated clothing. A separate sump would be located in the flame duct to collect spills of hypergolic propellants during fueling or spills of other hazardous

materials used in preparation for a launch. This sump would be thoroughly cleaned before a launch to eliminate the chance of the launch generated wastewater becoming contaminated with a hazardous waste. Hazardous waste would be disposed of as discussed in Section 4.6.1.3. Significant quantities of hazardous wastes would be generated during operations. These quantities have been estimated based on those generated at SLC-4 East operations during the Titan 34D program. Figure 4.6.3 (Summary, VAFB and SLC-7 Hazardous Waste Generation) shows the estimated hazardous waste quantities to be generated on South VAFB by the proposed action. This amount would result in an 11 percent increase over 1987 levels of hazardous waste generated on VAFB. This increase would lead to a greater utilization of the North VAFB EPA RCRA-permitted hazardous waste storage facility. The additional waste also could lead to a decrease in the life of the Class I landfill utilized for disposal. Recycling would be utilized as feasible, to decrease the effects of the additional waste on the landfill.

Provided all regulations were followed in the handling, transport, and disposal of the hazardous wastes, no significant impacts would result from the additional hazardous wastes generated by SLC-7 operations.

4.6.2.2 SLC-6

Domestic Waste

Construction

The existing sanitary sewage system at SLC-6 would be utilized during site modifications. No significant impacts would be expected.

Operations

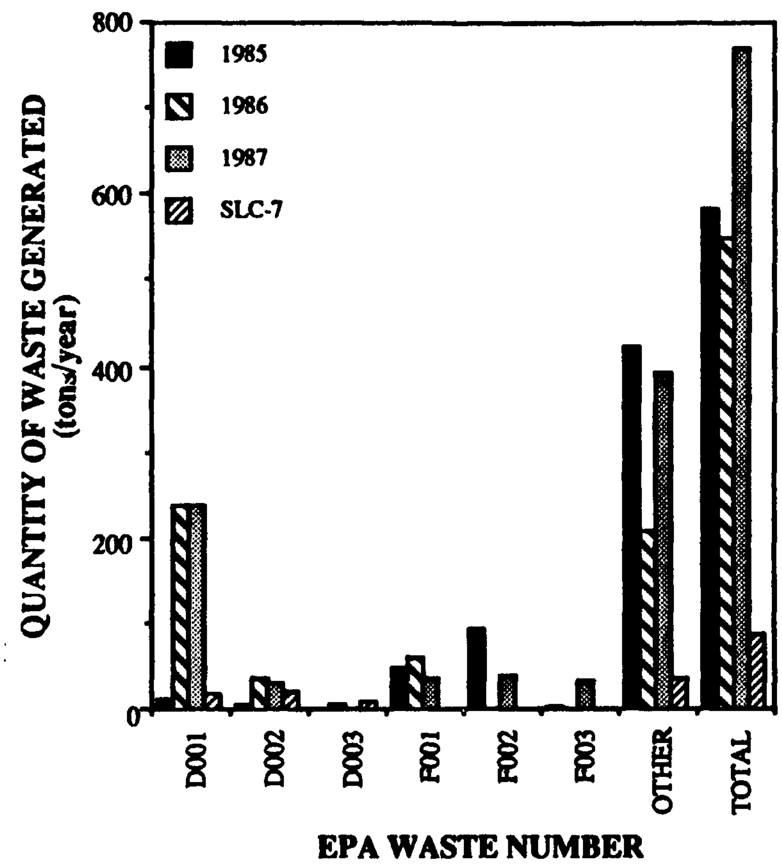
The existing sanitary sewage system at SLC-6 would be utilized during project operations. The capacity of this facility would be sufficient to accommodate the domestic waste generated at the site. Impacts would be similar to the Cypress Ridge site and would not be significant.

Industrial Waste

Construction

Modification of the SLC-6 site would require demolition of the existing launch mount and refitting of the mobile service tower (MST), access tower, fuel and oxidizer systems, and various other facilities located at SLC-6. Demolition of the launch mount would involve removal of about 1,800

HAZARDOUS WASTE DESCRIPTION	EPA WASTE NUMBER	QUANTITY OF WASTE GENERATED (TONS/YEAR)			
		1985	1986	1987	SLC-7
Ignitables (liquid and/or solid)	D001	11.9	238.1	238.6	19.0
Corrosives (acid or base liquids and/or solids)	D002	5.5	35.4	29.7	21.7
Reactives (solid and/or liquid)	D003	0	6.9	0	8.8
Halogenated Solvents (toxic poisons)	F001	47.5	60.9	36.6	0.6
Halogenated Solvents (toxic irritating poisons)	F002	92.1	0	40.4	0.02
Non-Halogenated Solvents (ignitable poisons)	F003	2.2	0.25	32.1	1.4
Contains Misc. EP Toxics, Listed Acute Hazardous Wastes, Listed Toxic Wastes, and California Listed Wastes	Other	422.8	208.1	392.7	36.9
TOTAL		581.9	549.7	770.1	88.4



Source: USAF 1988k.

FIGURE 4.6.3

SUMMARY VAFB AND SLC-7 HAZARDOUS WASTE GENERATION

cubic yards of reinforced concrete and 1,200 tons of steel. Modification of the MST and access tower would produce a large amount of steel. This steel would consist of platforms removed from the MST and various pieces of the access tower. The reinforced concrete would be disposed of at an approved spoil site. The steel would be sold as scrap.

Modification of SLC-6 to launch Titan IV vehicles would require replacing the existing fuel and oxidizer systems with larger systems. The systems presently in place would be decontaminated and removed. Much of this material would contain low levels of hypergolic contamination and could not be reused. The removed material would be placed in a Class II landfill for disposal.

Operations

Impacts caused by industrial waste generated during operations would be similar to the Cypress Ridge site and would not be significant.

Hazardous Waste

Construction

Hazardous waste generated during construction would consist of the same types of wastes as those specified for the Cypress Ridge site. As with the Cypress Ridge site, no significant impacts to the local environment are expected.

Unlike the Cypress Ridge site, the SLC-6 site contains hypergolic-contaminated fuel and oxidizer systems (see Section 3.6.3.3). In order to make these systems ready for use, they would be decontaminated. A complete decontamination would involve flushing with a liquid chemical. Three flushes, using a total of 82,000 gallons of liquid chemical would be needed. The residual liquid from the flushing would be handled as a hazardous waste. This waste would be treated at a RCRA permitted treatment facility.

Because of the large quantity of waste, treatment to remove the hypergolic contaminants and reuse of the liquid would be the most viable treatment technology. If handled and treated properly, the hazardous waste generated during the flushing activity would not have a significant impact on the local environment.

Operations

Impacts caused by hazardous waste generated during operations would be similar to the Cypress Ridge site.

4.6.2.3 Boathouse Flats

Impacts resulting from waste generation during construction and operations at the Boathouse Flats site would be the same as for the Cypress Ridge site.

4.6.2.4 Vina Terrace

Impacts resulting from waste generation during construction and operations at the Vina Terrace site would be the same as for the Cypress Ridge site.

4.6.3 CUMULATIVE IMPACTS

4.6.3.1 Domestic Waste

Re-activation of SLC-4 East and West occurred in late 1988, with a related increase in domestic waste production. The additional waste created by SLC-4 has been added to the Santa Maria sanitary sewage system in a manner similar to that planned for SLC-7. The present capacity of the SLC-4 sanitary sewage treatment plant is 15,000 gallons. Therefore, about 500 gallons per year are added to the Santa Maria system, an incremental increase over previous usage. This increase, along with the increase of SLC-7 operations, would not result in significant cumulative impacts to the Santa Maria facility.

4.6.3.2 Industrial Waste

Cumulative impacts caused by industrial waste would primarily be the result of concurrent operations at SLC-3 and SLC-4. The small amount of solid industrial wastes generated at these SLCs, with the addition of those generated at SLC-7, would lead to a decrease in the overall life of either the Class III landfill on North VAFB or the Class II landfill in Lompoc, depending on the choice of disposal site. This additional solid industrial waste would create an incremental decrease in the life of the landfill utilized.

The cumulative effect of bringing the SLC-3 and SLC-4 launch wastewaters to the SLC-6 evaporation ponds would be an additional one million gallons of water per year. With the addition of the SLC-7 launch wastewater (approximately 440,000 gallons for three launches per year), the total amount of water going into the ponds every year would be about 1.5 million gallons. Two

ponds exist at SLC-6, each capable of holding 1.5 million gallons. Normally, evaporation of water from the ponds would be expected to keep them from overflowing. If the ponds did become full, an NPDES permit would be obtained from the RWQCB before diverting the water to grade. The addition of the SLC-7 water would not have a significant impact on the capacity of the SLC-6 evaporation ponds.

If all of the wastewater from SLC-3, SLC-4, and SLC-7 were to be treated, it would have to pass through the SLC-6 wastewater treatment plant before being sent to the evaporation ponds. This plant can process 72,000 gallons of water in an eight-hour day. At this rate, it would take approximately 20 days to process all of the water the three SLCs would produce in one year. Due to the relatively brief amount of time required to process the launch wastewater, no cumulative effects would be anticipated to result from either its generation or disposal.

4.6.3.3 Hazardous Waste

The amount of hazardous waste generated in one year by the Titan IV/Centaur program due to the proposed action would be approximately equal to that generated by the Titan II and Titan IV programs at SLC-4 for one year. The amount of hazardous waste generated by operations would be approximately the same at SLC-6 and the undeveloped sites since operations would not vary greatly. Hazardous wastes would be generated on South VAFB at SLC-7 and on North VAFB at Buildings 8337 and 8401. The buildings on North VAFB also would be shared by the Titan II and Titan IV programs at SLC-4. Predicted wastes for the proposed Titan IV program and the Titan II and IV programs at SLC-4, plus the total VAFB hazardous wastes generated in 1987, are shown in Figure 4.6.4 (Summary, VAFB Cumulative Hazardous Waste Generation). The cumulative effect of the addition of the wastes from the proposed action to those already present would be an increase of about 11 percent per year. This would increase the amount of waste being stored at the EPA hazardous waste storage facility on North VAFB. Because this facility operates well below capacity, it would not be significantly impacted by the addition of the hazardous wastes generated by the proposed action. The hazardous wastes being disposed of in a Class I landfill would increase, thus reducing the life of the landfill. VAFB currently practices recycling and waste minimization wherever possible when hazardous wastes are involved. These practices would reduce to insignificant levels the impacts resulting from the addition of the hazardous wastes generated by the proposed action.

HAZARDOUS WASTE DESCRIPTION	EPA WASTE NUMBER	QUANTITY OF WASTE GENERATED (TONS/YEAR)			
		SLC-7	SLC-4	1987 VAFB TOTAL	CUMULATIVE VAFB TOTAL
Ignitables (liquid and/or solid)	D001	21.0	22.6	238.6	282.3
Corrosives (acid or base liquids and/or solids)	D002	22.4	21.8	29.7	73.9
Reactives (solid and/or liquid)	D003	8.8	8.7	0	17.5
Halogenated Solvents (toxic poisons)	F001	3.9	4.3	36.6	44.8
Halogenated Solvents (toxic irritating poisons)	F002	0.72	0.82	40.4	41.94
Non-Halogenated Solvents (ignitable poisons)	F003	2.21	2.33	32.1	36.64
Contains Misc. EP Toxics, Listed Acute Hazardous Wastes, Listed Toxic Wastes, and California Listed Wastes	Other	60.2	58.6	392.7	511.5
TOTAL		119.3	119.1	770.1	1008.5

Source: USAF 1988k.

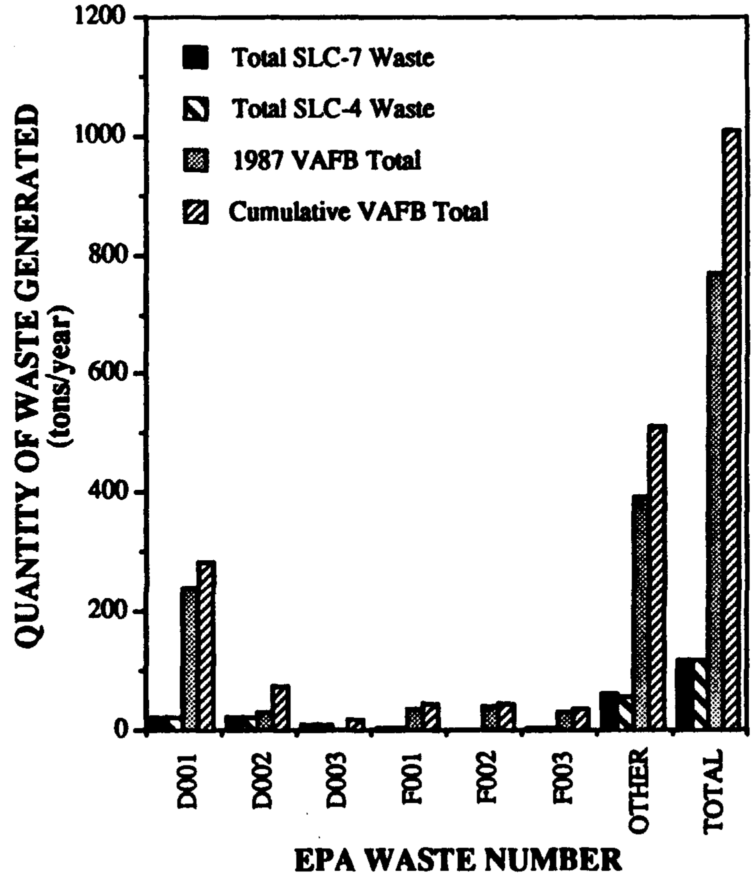


FIGURE 4.6.4

SUMMARY
VAFB CUMULATIVE
HAZARDOUS WASTE GENERATION

The cumulative impact of VAFB to the state of California hazardous waste disposal facilities is shown in Figure 4.6.5 (Comparison of VAFB and California Hazardous Wastes). Approximately 576,000 tons of hazardous waste were landfilled in California in 1987 (CDHS 1989), the most recent year with a complete set of data. The 1987 contribution of VAFB to the state was about 0.13 percent. With the addition of SLC-4 and the proposed action, the cumulative effect of VAFB would be approximately 0.175 percent of the total amount of waste landfilled in California in 1987.

4.6.4 MITIGATION MEASURES

Mitigation measures for the proposed Cypress Ridge and alternative SLC-6, Boathouse Flats, and Vina Terrace sites would be the same, as discussed herein. The construction contractors would be required to submit a waste management plan along with their general construction plans. The waste plan would identify the wastes to be generated during construction and specify how the contractors would manage and dispose of those wastes.

Existing evaporation ponds at SLC-6 would be upgraded in order to comply with RWQCB regulations regarding disposal of designated wastes.

Paints and primers with low contents of metals, such as zinc, lead, cadmium, etc., would be used on structures which come into contact with the deluge water (Launch Mount, Mobile Service Tower, Umbilical Tower, and Launch Support Structure). The use of such paints would minimize the content of metals in the launch water.

If capacities of existing VAFB hazardous waste storage facilities were found to be inadequate during proposed Titan IV/Centaur operations, USAF would be responsible for providing additional storage capacity.

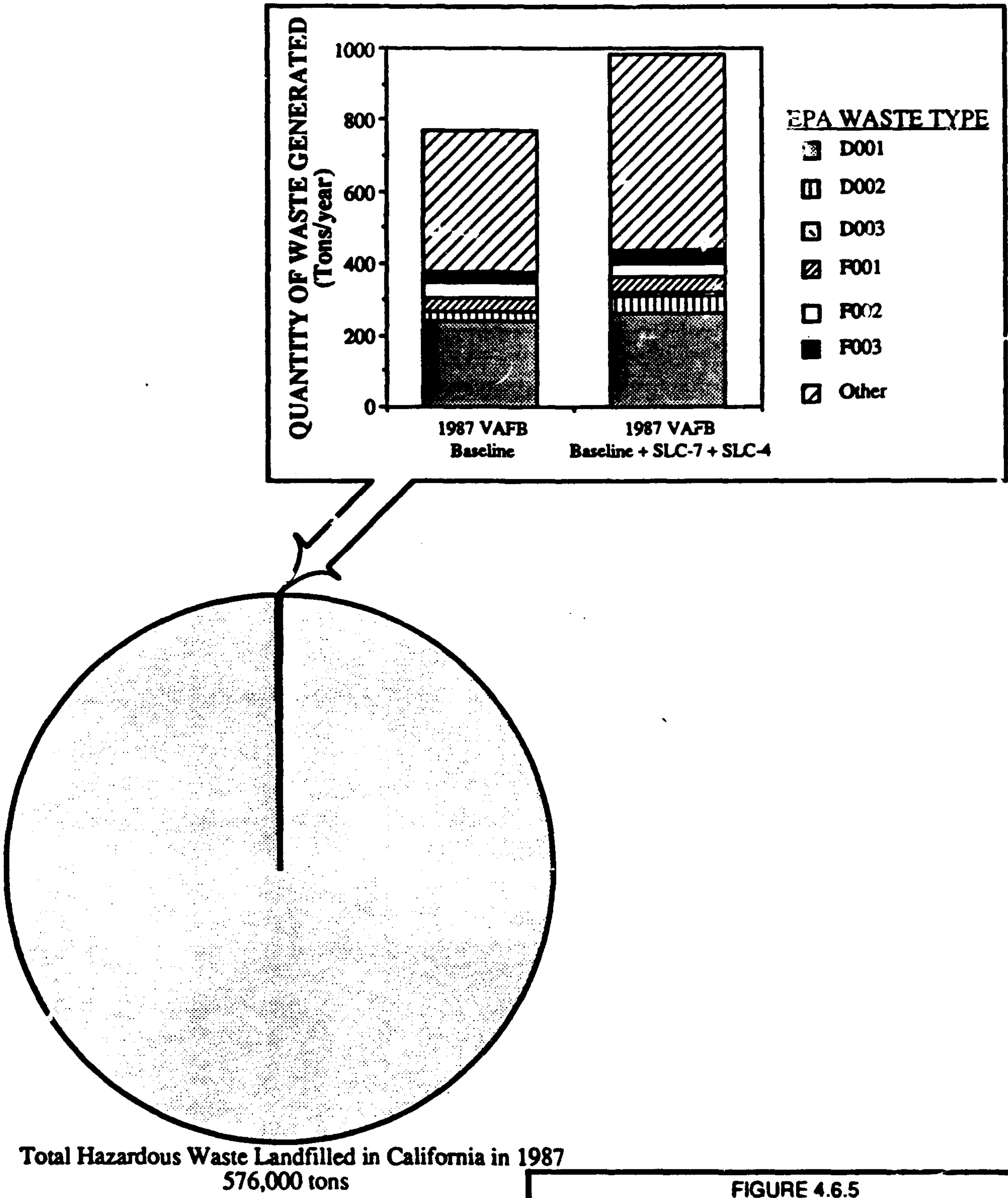


FIGURE 4.6.5

COMPARISON OF VAFB AND CALIFORNIA HAZARDOUS WASTES

Source: CDHS 1989.

4.7 NOISE

This section addresses potential impacts to humans from noise associated with construction and operation of the proposed project. Potential impacts to wildlife are addressed in Section 4.4. Events considered in this analysis are normal construction activities, space vehicle launches, and the unplanned occurrence of an explosion during liftoff.

An impact is considered significant if it would result in:

- Auditory damage to a sensitive receptor.
- Substantial increase in ambient noise levels in nearby areas of human activity.
- Substantial interference with daily activities in nearby residential communities.

4.7.1 REGIONAL IMPACTS

With the exception of launch events, construction and normal operations of the proposed action would not significantly impact the regional environment. Construction noises would create sound levels similar to an industrial area, with occasionally higher levels near equipment such as pile drivers and jackhammers. Because of the attenuation of sound levels over distance, sound from launch complex construction activities should be barely audible and, therefore, insignificant to surrounding communities (USAF 1978).

During a launch, sound levels generated would be more intense than either normal construction or operations events. Figure 4.7.1 (Projected Maximum Noise Levels from Titan IV/Centaur Launch) shows predicted sound contours for a Titan IV/Centaur launch from the proposed Cypress Ridge site. Sound levels could reach 170 dBA at the launch pad, but would attenuate to approximately 100 dBA at Lompoc and to slightly more than 90 dBA at Santa Maria. EPA maximum worker exposure levels are 115 dBA for periods of 15 minutes or less. Levels at both Lompoc and Santa Maria would be below the 115 dBA exposure limit and would persist for about 60 seconds, so no detrimental impacts are anticipated. Figure 4.7.2 (Typical Noise Levels of Familiar Sounds) provides further examples of noise levels created by a launch by comparing noise levels and easily recognizable sounds. The noise level associated with a launch would be characterized as a nuisance, with the chance of occurring three to four times per year (USAF 1988b). Also associated with the launch of a Titan IV/Centaur would be the occurrence of

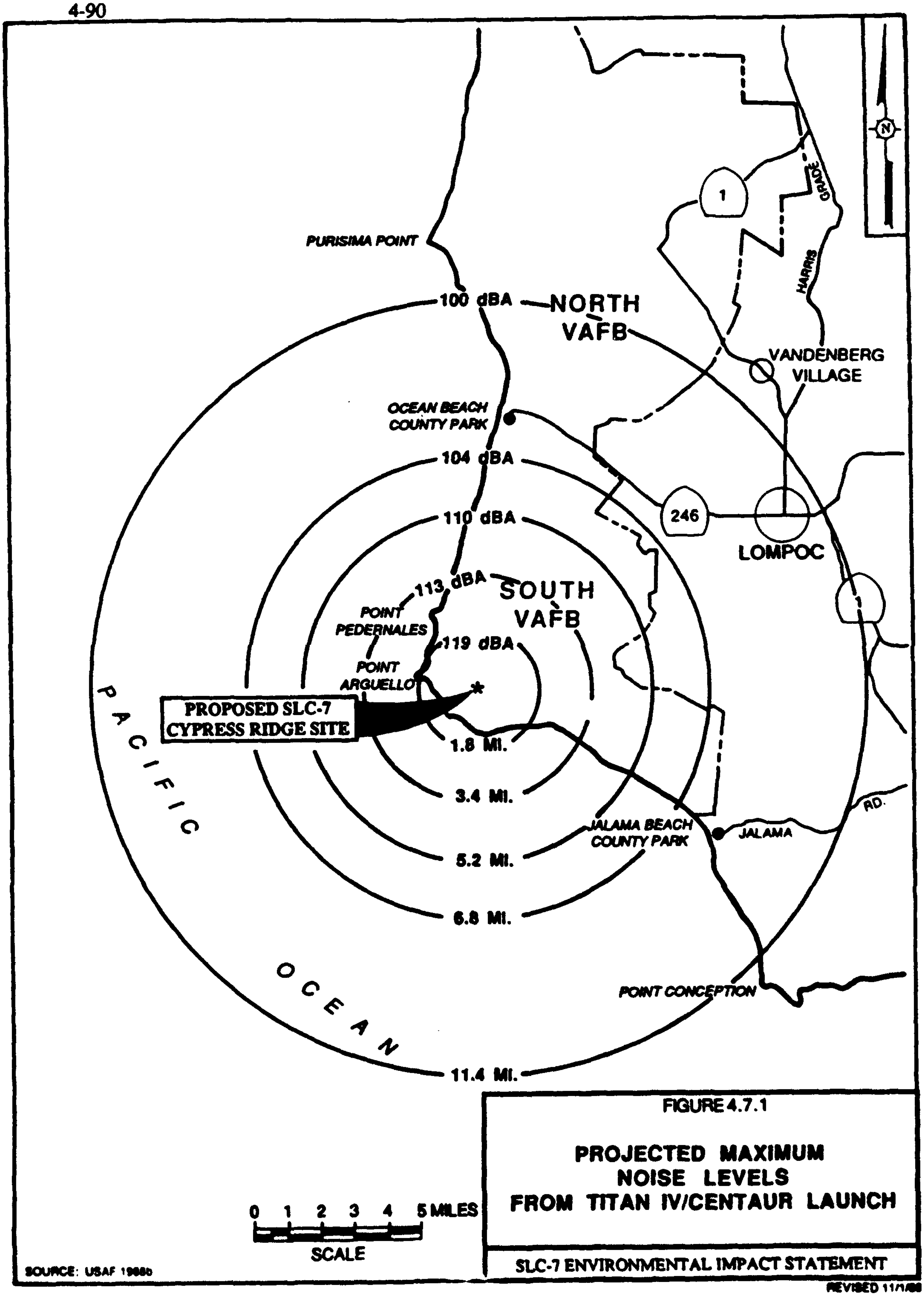


FIGURE 4.7.1

PROJECTED MAXIMUM NOISE LEVELS FROM TITAN IV/CENTAUR LAUNCH

SLC-7 ENVIRONMENTAL IMPACT STATEMENT

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	dBA	
	145	
Physically Painful	140	Sonic Boom
Extremely Loud	135	
	130	
	125	Jet Takeoff at 200'
Discomforting	120	Oxygen Torch
	115	Discotheque
	110	Motorcycle at 15' (Unmuffled)
	105	Power Mower at 3'
Very Loud	100	Newspaper Press
	95	Freight Train at 50'
	90	Food Blender
	85	Electric Mixer, Alarm Clock
	80	Heavy Truck at 50'
	75	Busy Street Traffic at 50'
	70	Average Traffic at 100', Vacuum Cleaner at 10'
Loud	65	Electric Typewriter at 10'
	60	Dishwasher at 10', Air Conditioning Unit at 15'
	55	Normal Conversation at 5'
	50	Typical Daytime Suburban Background
	45	Refrigerator at 10'
	40	Bird Calls
	35	Library
	30	
Quiet	25	
	20	Motion Picture Studio
	15	
	10	Leaves Rustling
	5	
Threshold of Hearing	0	

Source: City of Lompoc 1988a.

FIGURE 4.7.2

TYPICAL NOISE LEVELS OF FAMILIAR SOURCES

a sonic boom down range of the launch area. Because launch azimuths would be over water, significant effects of this sonic boom are not anticipated to extend to any human population centers (USAF 1978). (See Section 4.4 for potential effects to wildlife.)

An explosion of the Titan IV/Centaur during liftoff would produce locally high noise levels, about 200 dBA. Sound levels in Lompoc would be expected to be about 90 dBA, due to the attenuating effect of intervening topography (USAF 1988b). This noise level would not create regionally significant impacts. Shock wave overpressures associated with such an explosion would attenuate to less than 0.03 psi at Lompoc. This overpressure would likely not be noticed during normal daily activities and would not be expected to result in structural damage.

4.7.2 LOCAL IMPACTS

4.7.2.1 Cypress Ridge

Construction activities at Cypress Ridge would temporarily alter the local ambient noise levels. Impacts from construction noise would be experienced by individuals working in the area and would be controlled by workers wearing hearing protection, as required by the Occupational Safety and Health Administration (OSHA). Normal operations would produce noise levels similar to other industrial sites on VAFB. These are not considered to be significant. Adverse impacts from noise at Cypress Ridge would more likely be related to launch of a space vehicle than to normal operations.

An explosion of the Titan IV/Centaur vehicle during liftoff could create a very loud noise of about one second duration. Sound levels could approach 200 dBA near the launch pad. Sound levels of 200 dBA could cause hearing damage. These levels would be expected to attenuate rapidly with distance from the launch pad. Because launch safety procedures would not allow any personnel near the site during a launch, no adverse impacts to human hearing would be expected.

Noise produced by a launch could create noise levels as high as 170 dBA on the launch pad. This noise would last for approximately one minute and could cause hearing damage (USAF 1988b). Because of rapid attenuation with distance, sound levels would be expected to be much lower a short distance away, as shown in Figure 4.7.1. Launch safety procedures would keep all personnel out of areas where damaging sound levels would be present during a launch, thus eliminating adverse impacts to human hearing.

4.7.2.2 SLC-6

Impacts at the SLC-6 site due to noise created by construction, normal operations, and launches would be similar to those at the proposed Cypress Ridge site.

4.7.2.3 Boathouse Flats

Impacts at the Boathouse Flats site due to noise created by construction, normal operations, and launches would be similar to those at the proposed Cypress Ridge site.

4.7.2.4 Vina Terrace

Impacts at the Vina Terrace site due to noise created by construction, normal operations, and launches would be similar to those at the proposed Cypress Ridge site.

4.7.3 CUMULATIVE IMPACTS

Events currently taking place at VAFB that increase the ambient noise level in the Lompoc and Santa Maria areas are: (1) the infrequent launches of the Atlas and Scout missiles from South VAFB, one to two times per year, and (2) the launches of Minuteman missiles from North VAFB, about 10 times per year (US DOT 1988).

Launches of the Atlas (which is being phased out) and Scout produce sound levels in the Lompoc and Santa Maria areas lower than those for a Titan IV/Centaur. The Minuteman missile produces sound levels less than 50 dBA in Lompoc and 90 dBA in Santa Maria (USAF 1978). Noise from launches of these vehicles has not adversely impacted the surrounding area in the past.

With the modification of the SLC-4 facility, Titan II and Titan IV vehicles are planned for launch in 1989. The maximum launch rate of these vehicles would be three Titan II and two Titan IV vehicles per year. Noise levels in Lompoc, resulting from Titan II and Titan IV launches from SLC-4, would be about 90 dBA and 102 dBA, respectively, while noise in Santa Maria would be about 80 dBA and 92 dBA. Impacts associated with the launches of these two vehicles would be nuisance levels of noise, occurring a maximum of five times per year.

With the addition of the proposed action, launches from VAFB could increase by three per year. The cumulative impact of noise in the environment would be increased levels of noise during launches, occurring a maximum of 19 times per year. This noise could be characterized as a nuisance and would not result in harmful impacts to persons in the Lompoc or Santa Maria areas. Therefore, it is not considered to be significant.

4.7.4 MITIGATION MEASURES

4.7.4.1 Cypress Ridge

During launch of the Titan IV/Centaur, no personnel would be allowed in areas of the site that would be exposed to the greatest noise levels. Personnel stationed outside of the launch safety area would be required to wear hearing protection, as necessary.

The noise generated by a launch would be reduced sufficiently by distance to preclude the occurrence of harmful noise levels in either Lompoc or Santa Maria.

4.7.4.2 SLC-6

Mitigation measures for the SLC-6 site would be the same as those for the proposed Cypress Ridge site.

4.7.4.3 Boathouse Flats

Mitigation measures for the Boathouse Flats site would be the same as those for the proposed Cypress Ridge site.

4.7.4.4 Vina Terrace

Mitigation measures for the Vina Terrace site would be the same as those for the proposed Cypress Ridge site.

4.8 VISUAL RESOURCES

Implementation of the proposed project at one of the three undeveloped sites would alter its visual character from undeveloped to an intensive industrial-type use. If one of the undeveloped sites were chosen, the topography of the site would be changed by grading from a sloping terrace to level graded pads and graded slopes. Vegetation would be removed as part of grading operations and normal construction activities. Implementation of the proposed action at SLC-6 would not significantly change the visual character of the site.

If the proposed project were implemented at one of the undeveloped sites, the completed launch complex would cover about 50 acres, not including utility corridors. The most dominant visual features would be the 300-foot high Mobile Service Tower, Umbilical Tower, Titan IV/Centaur, Launch Service Structure, and Operations Support Building. Numerous support facilities would also be visible. Most facilities would be painted a neutral tone.

Activities associated with operation of the complex would also change the visual character of the three undeveloped sites and significantly increase the level of activity at SLC-6. There would be an increase in automobile traffic to the area for personnel, commodities, and space vehicle components. Heavy duty equipment would be used for on-pad assembly of the Titan IV/Centaur, and periodic launch of the vehicle would be visible. These operations would result in changing the character of the environment from passive to active at the proposed or alternative sites. If the proposed project were implemented at one of the three undeveloped sites, it would be a continuation, to the south, of the existing pattern of South VAFB launch complexes. At present, SLC-6 is the furthest south, approximately one mile north of the proposed Cypress Ridge site.

From the south, the view of SLC-6 is blocked by Cypress Ridge. As the other three potential sites are south of Cypress Ridge, they would be visible from the south, as well as from the ocean.

Impacts from implementation of the proposed action would be considered significant if they would result in:

- A substantial, negative aesthetic effect for a large number of people.
- Initial introduction of human elements into a pristine area.
- Degrading the aesthetic value of an area with artificial illumination.

4.8.1 REGIONAL IMPACTS

4.8.1.1 Cypress Ridge

As discussed in Section 3.8, regional views of the proposed project as completed would be available primarily from marine traffic, railroad traffic, and from locations surrounding Jalama Beach County Park. From a regional standpoint, the visual changes to the Cypress Ridge site would not significantly alter visual resources, due to the distance from which the limited views are available.

As viewed from Jalama Beach, the completed SLC-7 complex at Cypress Ridge would represent the most easily available and most frequently utilized regional (distant) viewpoint by the general public (approximately 255,000 to 315,000 visitors per year). The major project support structures, including the MST, LSS, OSB, and the Titan IV/Centaur (when on the pad), would be visible from this location. While the project would change the existing, predominantly undeveloped character of the coastline south of Point Arguello, it would not be a regionally significant part of the landscape and would not obstruct public views of the coastline.

Regional views of the site would also be available from fishing boats, pleasure boats, and railroad traffic. Specific views would vary, depending upon location of the observer. As with views from Jalama Beach County Park, these distant views would not be significantly altered or impeded by the proposed SLC-7 project.

The Cypress Ridge site would have onsite security and perimeter lighting to provide 24-hour visibility of the launch complex and adjacent area. The lights would be visible from offshore and, to some extent, from Jalama Beach. The overall effect would be similar to existing offshore oil platforms so, although it would represent a new area to be illuminated, it would not be the only lighted area either on South VAFB, or in the northern Santa Barbara Channel. It would, however, provide a source of light from an area that presently is not visible at night from Jalama Beach. The impact would not be regionally significant.

The proposed periodic launch of the Titan IV/Centaur would not be generally viewed by observers from Jalama Beach, marine locations, or the railroad. During launch operations, Jalama Beach is often closed, dependent on launch azimuth and meteorological conditions, marine traffic is discouraged by the USAF, and launches are scheduled when trains are not in the area. However, distant public views of the launched space vehicle from inland locations would be available.

4.8.1.2 SLC-6

The SLC-6 facility is not visible from Jalama Beach, so proposed modifications for the Titan IV/ Centaur would not impact either the daytime or nighttime viewshed from Jalama Beach County Park. Impacts to other viewing areas would be minimal since the facility is currently in place and modifications would not be regionally distinct.

4.8.1.3 Boathouse Flats

Regional impacts resulting from development of the Boathouse Flats site would be comparable to those at the proposed Cypress Ridge site.

4.8.1.4 Vina Terrace

Regional impacts resulting from development of the Vina Terrace site would be comparable to those at the proposed Cypress Ridge site.

4.8.2 LOCAL IMPACTS

4.8.2.1 Cypress Ridge

As discussed in Section 3.8, local views of the completed project would be limited due to South VAFB access restrictions. Occasional views would be experienced by marine and railroad traffic. The proposed project would alter the visual character of the project site from undeveloped to an active, industrial-type use.

Local public views of the site from occasional marine and daily train traffic would vary, depending upon the observation point. When viewed from nearby locations, the project could be a dominant visual feature due to its scale and contrast. The completed project would not impede significant local public views of the coastline.

4.8.2.2 SLC-6

Use of the SLC-6 site would not significantly alter the visual character of the site, as the main structures are already present.

4.8.2.3 Boathouse Flats

Implementation of the Boathouse Flats alternative would result in a developed complex visually similar to the proposed site. However, given the relatively flat terrain of the Boathouse Flats area, the complex would be in sharp contrast and scale to the natural surroundings.

Local public views of the project from marine or railroad locations would vary. However, the proximity of this site to the coastline would permit closer views from these sources. Significant views of the coastline from the railroad would be interrupted by the constructed SLC-7 project at this location.

4.8.2.4 Vina Terrace

Implementation of the proposed project at Vina Terrace would result in a project complex visually similar to the proposed complex at Cypress Ridge. Local public views of this location would be limited by its more remote location. The completed project would not interrupt views of the coastline from marine or railroad observers. However, the elevated terrace location could make it more visually prominent than at one of the other three sites. In addition, this site could be more visually apparent than the others because additional site grading and extended access roadways would be necessary for construction at the elevated terrace location.

4.8.3 CUMULATIVE IMPACTS

If the proposed project were implemented at one of the undeveloped sites, it would replace SLC-6 as the most southerly extension of the existing array of South VAFB launch complexes. From a regional perspective, this new launch complex would be visible from commercial and recreational marine traffic and from Jalama Beach. From these locations, it would represent an additional human element in the near-shore viewshed, which already includes offshore oil drilling platforms.

If constructed at an undeveloped site, the new space launch complex would be a new visual element from Jalama Beach (i.e., other SLCs are not visible from here) and, as such, would affect the visual resources of that location. However, as offshore oil platforms currently are visible from the beach and comprise a component of the existing environment, the space launch complex would not represent the first man-made element within the Jalama Beach viewshed.

From a local perspective, implementation of the proposed action at one of the undeveloped sites would add a major visual element to an undeveloped area of South VAFB, in addition to existing Space Launch Complexes 3, 4, 5, and 6, the STS power plant, and other established facilities.

Implementation of the proposed action at SLC-6 would not result in the addition of major visual elements to an undeveloped area. Therefore, the SLC-6 alternative would not result in a cumulative effect to either the local or regional visual environments.

4.8.4 MITIGATION MEASURES

4.8.4.1 Cypress Ridge

No significant impact to visual resources is expected. The proposed project has been located at a site where local public views generally are not available. Remote views are attenuated by distance. The project at this location would not block significant views of the coastline.

Nighttime visibility of the site should be minimized by use of low glare lights, where appropriate. As feasible, lighting should be shielded from areas outside the perimeter of the launch complex.

4.8.4.2 SLC-6

Mitigation measures are the same as those for the proposed Cypress Ridge site.

4.8.4.3 Boathouse Flats

Implementation of the proposed project at this location would block coastline views from the railroad. No mitigation measures for this impact are available. Mitigation measures for lighting are the same as those for the proposed Cypress Ridge site.

4.8.4.4 Vina Terrace

The elevated location of the project at Vina Terrace could make the project more visible. No mitigation measures for this impact are available. Mitigation measures for lighting are the same as those for the proposed Cypress Ridge site.

4.9 CULTURAL RESOURCES

Prior to analysis of the proposed action, a cultural resources literature search and surface inventory were conducted to delineate the known and suspected site areas, as discussed in Section 3.9. Areas that would be potentially affected are subject to the Federal Advisory Council on Historic Preservation (ACHP) procedures for compliance vith Section 106 of the National Historic Preservation Act (NHPA), which describe requirements for documentation of effect of undertakings on historic properties subject to the Section 106 review process.

Within the Section 106 process, a Determination of Effect must be made by the USAF for properties determined as eligible for inclusion in the National Register of Historic Places (NRHP). A surface inventory of the area of the proposed action has been completed, and archaeological sites and areas of potential archaeological sites have been identified. Sites that are located within the potential construction area will need to be studied to determine their eligibility for listing in the NRHP. These sites are described in Section 3.9. Results of the inventory and subsurface testing program are incorporated into a Determination of Eligibility, submitted to the State Historic Preservation Officer (SHPO) for concurrence.

Once sites are determined to be eligible, the USAF determines whether there would be an effect to the site due to the proposed action. Those sites that would be adversely affected may be mitigated through a Research Design and Treatment Plan designed in consultation with SHPO and the Advisory Council.

The USAF Determination of Effect and, as necessary, the Research Design and Treatment Plan, are submitted to the SHPO for approval and then to the ACHP for final approval.

Impacts to historic or prehistoric cultural resources would be considered significant if they were to result in:

- Disruption to an eligible historic or prehistoric site prior to data recovery or other appropriate mitigation.
- Disruption to a noneligible site prior to adequate documentation or other, appropriate mitigation.
- Disruption to a paleontological site, except in association with a scientific study.

4.9.1 REGIONAL IMPACTS

4.9.1.1 Historic Properties

It is anticipated that implementation of the proposed action at the proposed or alternative sites would not have regional impacts. The La Purisima Mission, about 15 miles northeast of the project area, is outside the area of potential acidic deposition. Impacts to the mission would not be expected, due to building construction type and location outside the sonic boom focus area.

Implementation of the proposed action at one of the undeveloped sites may result in placement of soil from the project area in the old borrow pit at Point Pedernales. Such action would not affect the setting of the shipwreck at "Destroyer Rocks" or the anchor monument at Point Pedernales.

4.9.1.2 Paleontology

The potential paleontological resources in areas of North VAFB would not be affected by implementation of the proposed action at the proposed or alternative sites.

The caliche plant fossils on San Miguel Island are naturally impacted by the effects of wind, rain, and animals. They also may be affected by the shock from sonic booms associated with space vehicle launches. It is possible that a sonic boom from the launch of a Titan IV/Centaur could cause breakage of some, perhaps many, of the more fragile caliche fossils. However, such an occurrence would merely speed up by weeks, or at most a few years, an inevitable, natural process. Therefore, such impact would not be significant.

4.9.2 LOCAL IMPACTS

4.9.2.1 Cypress Ridge

Historic Properties

Potential effects to the former U.S. Coast Guard Rescue Station (Boathouse) would result from overpressures associated with a normal launch and overpressures created by the explosion of the launch vehicle on the launch pad. Overpressures associated with a normal launch would approach 0.003 psi. This pressure corresponds to a probability of window pane breakage of about 10^{-6} broken

panes/total panes per event (Siskind, et al. n.d.). Potential impacts to the structures would be the possibility of window pane breakage and of cracked plaster. The possibility of structural damage to the buildings is unlikely from the overpressures created by a normal launch.

Overpressures created by the explosion of the launch vehicle on the launch pad would approach 0.07 psi at the Boathouse. Overpressures of 0.5 to 1.0 are usually associated with broken window pane glass. The overpressure produced from an explosion could potentially lead to broken windows in the buildings and cracked plaster on the walls. Structural damage to the buildings is unlikely at this pressure level. Normal launch events also would result in near-field acidic deposition, which could lead to exterior damage to the paint and roofing of the Boathouse. Routine maintenance of the facility is currently done to combat the effects of the salty sea air. Acidic deposition from Titan IV/Centaur launches would accelerate the existing rate of paint deterioration, but would not result in structural damage. There could be a need for more frequent maintenance relative to the acidic deposition.

Archaeological Resources

Potential effects to the rock art site primarily would result from vibration and emissions associated with launch events.

The potential extent of such effects is not known, but could be destructive. Potential impacts from rocket firings at SLC-6, identified by Spanne (1984), are anticipated to be similar to effects from launches at Cypress Ridge. One effect involves the potential for drift of the ground cloud and subsequent acidic deposition. The effect of HCl on the pigments is considered potentially destructive. Another effect would be vibrations caused by launch events, which could result in the collapse and crumbling of portions of the already fractured painted panel (Spanne 1984). These impacts would be mitigated according to SHPO criteria and, therefore, would not be significant.

Underground Piping, Communications, and Surface Electric Power

The excavation of trenches for pipelines in archaeological deposits destroys features and relationships between different types of artifacts and plant and animal remains in the site. Associated activities, such as placement of pipe, that involve movement of equipment in sandy soil also have the potential to disturb archaeological sites.

Excavation for placement of power poles, grading for access roads, and movement of heavy equipment during installation and maintenance of poles can cause significant disturbances.

Site SBa-1941, as well as other sites indicated by isolated artifacts found along the crest of Cypress Ridge, would be disturbed by the excavation of the trench for the water supply line from V-33 to the Cypress Ridge site.

Establishment of the underground piping and communications cable and electric power corridor may impact the following sites:

- SBa-1149
- SBa-1687
- SBa-1114
- SBa-654
- SBa-551
- Isolate E-12
- Intersection of N Road with Coast Road
- SBa-1679
- SBa-662
- Isolate Spanne 1974
- SBa-1109
- SBa-1105

Construction Area

Most cultural deposits in this area are apparently buried, and many surface activities relative to establishing and operating the construction laydown area would not disturb subsurface deposits. However, excavations or other subsurface disturbances, such as grading associated with preparation or use of the area, have the potential to disturb archaeological site deposits. Site SBa-1117 would be disturbed by grading during the placement and later removal of topsoil and other activities, including driving vehicles over the site.

Proposed Manzanita Road Borrow Site

Use of this borrow site to obtain an estimated maximum of 200,000 to 600,000 CY of fill would involve excavation outside of the disturbed area and likely result in disturbance to intact soil deposits. If borrow were restricted to the existing disturbed area, the excavation could be designed to have little impact. The actual extent and significance of impacts would be determined based on the results of a subsurface testing program.

Paleontology

Road construction, trenching, or grading the terrace deposits or Monterey Formation may create an impact on paleontological resources. However, at Cypress Ridge, the older terrace sands and colluvium are not likely to contain significant resources that could be impacted by the project.

Excavation of the Monterey shale has a greater chance of impacting fossil resources, but history shows the recovered fossils would probably be insignificant. Generally, potential impacts would be limited.

4.9.2.2 SLC-6

Historic Properties

The former U.S. Coast Guard Rescue Station is further from the SLC-6 site than from the proposed Cypress Ridge site, so impacts resulting from operations at SLC-6 would be somewhat less than those from operations at Cypress Ridge. Overpressures created by a normal launch would be 0.001 psi, similar to those from Cypress Ridge, while those created by an explosion would be 0.06 psi, compared to 0.07 psi from Cypress Ridge. Acidic deposition effects would be somewhat less than those related to operations at Cypress Ridge (see Figures 4.3.1 and 4.3.2).

Construction Area

Construction activities would be conducted only in areas which previously have been disturbed. Therefore, no archaeological resources would be affected.

Potable Water and Utility Lines

Existing utilities are in place and would be used for the proposed action. Therefore, no cultural resources would be affected.

Proposed Manzanita Road Borrow Site

As proposed, construction at the SLC-6 site would not involve the use of offsite fill. Therefore, no impacts to the borrow site would be anticipated for this alternative. All construction spoil from SLC-6 would be disposed of in an approved VAFB landfill.

Paleontology

As proposed, no construction would occur in undisturbed areas. Therefore, no impacts to paleontological resources are anticipated.

4.9.2.3 Boathouse Flats

Historic Properties

The former U.S. Coast Guard Rescue Station is nearer to the Boathouse Flats site than to the Cypress Ridge site, so impacts resulting from operations at Boathouse Flats would be slightly greater than those from operations at Cypress Ridge. Overpressures created by a normal launch from Boathouse Flats would be 0.003 psi, similar to those from Cypress Ridge, while those created by an explosion would be 0.2 psi, compared with 0.07 psi from Cypress Ridge. The increase in overpressure from 0.07 psi to 0.2 psi would lead to a greater chance of window breakage in the Coast Guard buildings, although structural damage would still be unlikely. Acidic deposition effects to the buildings would be similar to those from operations at the Cypress Ridge site.

Construction Area

Most archaeological sites in the Boathouse Flats area are located on or near the western and southern edge of the planned construction area. It is possible that some would be graded during construction of perimeter fence lines or other activities. It is also possible that some would experience erosion caused by altering the landscape during project construction.

Sites that might be damaged include Oil Well Canyon Complex sites SBa-1545, SBa-1561, and SBa-1560. Sites along the southern part of the project that may be damaged include E-69, the new prehistoric site area located near the bluff edge between the coast and previously recorded site SBa-1560, prehistoric site SBa-636 on the coastal bluff, and historic dump site SBa-1558. Prehistoric chert quarry site SBa-1542, along the eastern edge of the project area, also may be damaged by construction. Final design and subsequent testing would be necessary to define impacts.

Potable Water and Utility Lines

Trenching for the water pipeline could disturb buried site deposits where the water line crosses the creek in Oil Well Canyon. If the isolated flakes at E-60 indicate the presence of a site, trenching for the water line could disturb the site. The main chert deposit at SBa-1111 is apparently near the intersection of D Road and Coast Road. It appears that the pipeline trench would pass through or near this area. Final design and subsequent testing would be necessary to define impacts.

Trenching for utilities could affect site SBa-1149. A testing program would be necessary to define impacts. At lower Oil Well Canyon, excavation of pipeline trenches or construction of power pole corridors could result in disturbance to sites SBa-1547, SBa-712, SBa-1544, SBa-1545, SBa-1543, and SBa-1546. Testing of specific routes would be necessary to define impacts.

Proposed Manzanita Road Borrow Site

Impacts to potential cultural resources would be similar to those for the Cypress Ridge site. Construction at Boathouse Flats would involve an estimated maximum of 0.4 million CY of fill and would likely result in disturbance to intact soil deposits. A subsurface testing program would be necessary to define impacts.

Paleontology

Excavation and grading at the Boathouse Flats site has a greater potential for impacting paleontological resources than at the Cypress Ridge site. The lower terrace deposits are regionally recognized as yielding significant fossil remains. Once below the unconsolidated sediments, however, the Monterey shale bedrock also may contain fossils, but they would not likely be significant.

4.9.2.4 Vina Terrace

Historic Properties

Impacts to historic properties under this alternative would be the same as for the proposed Cypress Ridge site.

Construction Area

The construction area could affect:

- Isolates E-61, E-93, and E-94.
- Isolate 4 Spanne 1984 .

Final design and testing would be necessary to determine impacts.

Access Road and Utility Corridor

Archaeological resources that may be impacted by construction of an access road and utility corridor are:

- Isolates E-37, E-36, E-35, E-34, and E-33.
- Site SBa-1941.

Final design and testing would be necessary to determine impacts.

Proposed Manzanita Road Borrow Site

As proposed, construction at the Vina Terrace site would not involve the use of offsite fill. Therefore, no impacts to the borrow site would be anticipated for this alternative.

Paleontology

The potential for significant impacts to paleontological resources at the Vina Terrace alternative site is low, due to the thinness of the sediments and the rarity of significant resources in the shale. Generally, impacts would be limited.

4.9.3 CUMULATIVE IMPACTS

4.9.3.1 Prehistoric Resources

Implementation of the proposed action at one of the three undeveloped sites could result in impacts to certain archaeological sites that cannot be avoided by project facilities. However, as a result of cultural resources surface and subsurface investigations conducted in compliance with state and federal regulations, the proposed action provides the impetus for further study of the archaeological

resources within the study area. Results of subsurface testing and evaluation would contribute to the knowledge gained to date relative to the archaeological record in general and the Chumash culture in particular.

There would be no cumulative impacts to prehistoric resources from implementation of the proposed action at SLC-6.

4.9.3.2 Paleontological Resources

The potential impacts to paleontological resources would be site-specific. If such resources were discovered, analysis and testing would contribute to the knowledge gained to date relative to the paleontological record. Adherence to proper procedures would result in insignificant impacts.

To the extent that the caliche plant fossils on San Miguel Island are sensitive to overpressure and sonic boom, the addition of Titan IV/Centaur launches would increase their exposure to such events. This could further increase their rate of deterioration. These impacts would be the same for implementation of the proposed project at either SLC-6 or one of the undeveloped sites.

4.9.4 MITIGATION MEASURES

Mitigation of the loss of cultural resources impacted by construction of the proposed project could be achieved through avoidance, data recovery, or a combination of both. Mitigation measures would not be required for implementation of the proposed project at SLC-6 since no impact to cultural resources is expected to occur. Avoidance is the preferred mitigation according to federal guidelines and is usually the most cost effective. In most cases, implementation of specific mitigation measures requires the conduct of subsurface testing programs to determine the boundaries, content, and significance of sites.

If sites are determined to be eligible and their disturbance cannot be avoided, then data recovery programs would be conducted in accordance with the research questions currently recognized in the VAFB area. Data recovery programs would attempt to describe features that would be impacted and their spatial relationships. Representative samples of artifacts and plant and animal remains should be taken. Data recovery programs should be consistent with the "Secretary of the Interior's Standards and Guidelines for Archaeology and Historic Preservation" (Federal Register V.48, No. 190: 44716-44742) and the Advisory Council's "Treatment of Archaeological Properties: A Handbook."

Teams of qualified archaeologists and Native Americans would be present to monitor all ground disturbance during construction. The numbers of teams and monitors would be determined in consultation with USAF and would depend on the results of archaeological testing and the level of construction activity at a given time. Observers also would be present to prevent unauthorized movement of equipment outside of staked areas, into sensitive areas, and/or artifact collection by project personnel. They would also record discoveries of remains not identified during subsurface testing programs. If unanticipated discoveries were made during construction, work in the area would cease until after necessary data recovery had been conducted. Also, qualified personnel would monitor for the presence of paleontological resources during earth moving activities.

Mitigation of the rock art site would involve pre-launch documentation and post-launch monitoring.

4.9.4.1 Power and Pipeline Corridors

For the three undeveloped sites, certain construction procedures would be followed in order to minimize potential impacts to archaeological sites. Prior to construction, an access corridor approximately 30 to 40 feet wide and turn-around areas would be staked. Construction vehicles and activities would be limited to the staked areas.

These actions would not be necessary for construction at SLC-6, as utility corridors are already in place.

Electrical Power Line

Impacts of the installation and maintenance of the electrical power lines would be avoided to the extent possible by placing poles outside intact site areas and designing access roads to avoid site areas. Further, areas that already have been disturbed would be utilized so as to avoid intact site areas, such as at SBa-1679, where the western edge has been eliminated by previous grading.

In areas of known sites, such as SBa-551, SBa-1105, SBa-662, Spanne 1974 isolate, and SBa-1109, testing would be conducted to discover a corridor of least impact. Poles would be placed to avoid site areas, and access to the site area would be restricted. A data recovery program may be necessary to recover areas of unavoidable disturbance.

4.9.4.2 Cypress Ridge

Underground Piping and Communications Cable

At SBa-654, it is possible that the planned route avoids intact portions of the site. If intact deposits are found in the area of the planned trench, disturbed areas would be identified adjacent to the Coast Road to find a route to avoid intact site deposits.

Construction Area

A large portion of archaeological site SBa-1149 is within the Cypress Ridge construction area. Results of the 1988 surface inventory indicate that the boundaries of SBa-1149 would be revised after subsurface testing. Because avoidance is not feasible for much of this site, data recovery would be necessary at areas determined to be significant.

Preparation of the construction laydown area or conduct of activities that result in excavation of soil could affect buried site deposits. Testing would be conducted to determine the impact of any required excavation. If excavations would disturb significant site areas, archaeological data recovery would be conducted. Excavation in the area would be avoided when possible.

Utility and Communications Corridors

To the extent possible, alignments for underground and aboveground corridors for water, power, and communications lines and access roads would be designed to avoid intact archaeological sites. Where avoidance is not possible, data recovery programs may be necessary. In areas where there are surface indications of a potential subsurface site, testing would be conducted to determine the presence and extent of buried site deposits. Subsequent mitigation measures could be either avoidance or, if necessary, data recovery. These measures would apply to SBa-654, E-12, N Road-Site 1-Locus C, SBa-1114, SBa-1686, SBa-1149P and SBa-1941. In areas where previous activities have disturbed a site, such as SBa-551, where the Coast Road was cut through an intact site deposit, new activities would be confined to the disturbed area to the extent practicable.

Former U.S. Coast Guard Rescue Station

There would be an accelerated maintenance program for structures at the former U.S. Coast Guard Rescue Station. This would involve monitoring and repair of launch-related impacts resulting from acidic deposition and vibration. This would include cleaning and painting of building surfaces and repair of structural damage, such as to windows and chimneys.

4.9.4.3 SLC-6

Since there would be no new construction in undisturbed areas, no mitigation measures would be required for the construction area. Since utility corridors are in place, no mitigation measures would be required for either the underground piping and communications cable or utility and communications corridors.

Mitigation measures for the former U.S. Coast Guard Rescue Station (Boathouse) would be the same as for the proposed Cypress Ridge site.

4.9.4.4 Boathouse Flats

Construction Area

To the extent practicable, the archaeological site complex at the mouth of Oil Well Canyon would be avoided by project design. Fill (including the fill previously placed over the area during the External Tank Tow Route construction) would be utilized in order to place underground utilities over the top of known archaeological sites. The project also would avoid utilizing areas along the bluff edge due to the potential to impact cultural materials located there.

Subsurface testing would be conducted to confirm the absence of subsurface deposits in the center portions of the area where isolated shells or flakes have been found. The mitigations proposed for sites SBa-654, SBa-551, find E-12, and N Road-Site 1-Locus C would be the same for this alternative as for the proposed Cypress Ridge site. To the extent possible, alignment of underground utilities and access roads would be designed to avoid disturbance to known or suspected sites such as SBa-1149.

If subsurface deposits were discovered during testing programs, corridors would be redesigned, as practicable, to avoid them, such as at sensitive areas near the Oil Well Canyon crossing, isolate

E-60, and SBa-1111. Trenches for utility lines would be excavated in the fill placed across Oil Well Canyon during construction of the External Tank Tow Route to avoid disturbance of SBa-1547, SBa-712, SBa-1544, SBa-1545-1543, and SBa-1546.

Former U.S. Coast Guard Rescue Station

Mitigations would be the same as for the proposed Cypress Ridge site.

4.9.4.5 Vina Terrace

Construction Area

Testing in the vicinity of isolates E-61, E-93, E-94, and the Spanne 1984 isolate 4 would be necessary to determine impacts and appropriate mitigation measures. If sites are present in the area, a data recovery program may be necessary. The mitigations proposed for sites SBa-654, SBa-551, find E-12, and N Road-Site 1-Locus C would be the same for this alternative as for the proposed Cypress Ridge site.

Utility and Communications Corridors

Testing in the vicinity of isolates E-37, E-36, E-35, E-34 , E-33, and site SBa-1941 would be necessary to determine impacts and appropriate mitigation measures. Testing in the vicinity of the Oil Well Canyon creek crossing and the Spanne 1984 isolate 4 would be necessary to determine impacts and appropriate mitigation measures.

Proposed Manzanita Road Borrow Site

Mitigation measures for the proposed borrow site would be determined based on the results of the subsurface testing program.

Former U.S. Coast Guard Rescue Station

Mitigations would be the same as for the proposed Cypress Ridge site.

4.9.4.6 National Register District

It is recommended that a National Register of Historic Places district be created and include all of South VAFB. Such a district would both protect a group of significant archaeological resources and save administrative effort and time delays required to determine effects and design treatment plans on a site-by-site basis. The adoption of a district and a Historic Preservation Plan (which would encompass the proposed SLC-7 project) would provide guidance in planning the development of South VAFB and would enable the base archaeologist to make administrative decisions which otherwise would require separate review by the SHPO and the Advisory Council.

The historic Chumash village of Nocto is near the center of South VAFB and would be included in the district. Sites which may have been permanently occupied are located near the mouth of Honda Canyon, the lower portion of Red Roof Canyon, the lower portion of Oil Well Canyon, and the vicinity of the Sudden Ranch headquarters, east of Nocto. Other sites within South VAFB also may be remains of permanently occupied settlements. The established district would include the full range of site types from different time periods and provide opportunities for studies of changes in land use and settlement patterns.

The need for this mitigation measure would be less in the event the SLC-6 alternative is chosen.

4.9.4.7 Paleontological Resources

Mitigating potential impacts to paleontological resources would involve construction surveillance and appropriate response. During earth moving, construction monitors would notify construction personnel whenever vertebrate fossils were found. The monitors would direct excavation away from the site until a qualified paleontologist could determine the significance of the remains. If considered significant, remains would be salvaged and removed for study and curation. These measures can mitigate the impacts of construction to insignificance.

4.10 TRANSPORTATION

Certain impacts are associated with an increase in traffic on any roadway. These impacts include reduced levels of service for the roadway and its intersections. Impacts on transportation were developed using the assumptions made in Section 4.12, Socioeconomics. Two different phases were assumed to exist with regard to the proposed project: (1) facility construction/ground equipment installation, and (2) operations. In order to look at a worst-case basis, the number of construction and operations personnel was assumed to be the same for SLC-6 as for development of the proposed action at one of the three undeveloped sites. It was further assumed that there would be one vehicle driven to the site by each employee. Personnel traveling to the site were assumed to live in five different regions:

- City of Lompoc.
- Vandenberg Village and Mission Hills.
- Santa Maria Valley.
- Santa Ynez and South Santa Barbara County.
- VAFB Housing (on-base).

The estimated personnel living in each area for project construction and operations is shown in Table 4.10.1 (*Estimated SLC-7 Personnel Requirements*). The table reflects the anticipated differences in construction personnel with project implementation at an undeveloped site compared to implementation at SLC-6. It also shows that operations personnel and, therefore, traffic, would essentially be the same for all four sites. The number of persons required for operations would not change depending upon the alternative chosen for implementation since operations are not expected to vary greatly. Based on ease of travel, a specific route to the VAFB South Gate was assumed to be most likely for personnel in each area (see Figures 3.10.1 and 3.10.2). For each route, one or more intersection(s) was evaluated for potential impacts to existing traffic.

An impact would be considered significant if it resulted in one or more of the following:

- A decrease in Level of Service (LOS) values for roadways and/or intersections by one or more levels.
- A need to upgrade existing traffic control signalization at one or more intersections.
- A need to upgrade one or more roadways or intersections to accommodate an increase in traffic at existing LOS.
- The design capacity of a roadway or intersection to be exceeded.

TABLE 4.10.1

ESTIMATED SLC-7 PERSONNEL REQUIREMENTS

AREA OF RESIDENCE	SCL-7 PROJECT PHASE		
	FACILITY CONSTRUCTION/ AEROSPACE EQUIPMENT INSTALLATION		OPERATIONS
	UNDEVELOPED SITE	SLC-6	
City of Lompoc	165	90	80
Lompoc Valley	60	33	85
Santa Maria Valley	200	108	150
VAFB Housing	100	54	70
Santa Ynez, South Santa Barbara County, Ventura County	25	15	15
TOTAL	550	300	400

Note: Estimates reflect anticipated peaks in personnel requirements during project construction and operations.

Source: Environmental Solutions, Inc. estimates 1988.

4.10.1 REGIONAL IMPACTS

Due to characteristics of regional housing and surface patterns, transportation impacts related to the proposed action would occur primarily in Lompoc, as persons commute to and from work at South VAFB.

Intersections in Lompoc that were evaluated are: (1) "H" Street/Central Avenue, (2) "H" Street/ Ocean Avenue, (3) Highway 246/Highway 1, and (4) Union Sugar Avenue/Highway 246. In addition, the intersection of Highway 246/VAFB South Gate and the VAFB Main Gate may also be affected by the increased levels of traffic. Several of these intersections have been identified by the city of Lompoc as being potential points of impacts for increased traffic flow (City of Lompoc 1988b) and are evaluated below.

Each intersection was analyzed, and Levels of Service (LOS) were estimated, based on Intersection Capacity Utilization (ICU) values, using the number of additional vehicles that would be arriving at each intersection during peak traffic hours. These analyses were conducted utilizing the projected personnel requirements for implementation of the proposed action at one of the undeveloped sites since this represents a worst case. Impacts from implementing the proposed action at SLC-6 would be smaller for all conclusions reached here due to reduced personnel requirements. Figure 4.10.1 (Potential Intersection Impacts, Lompoc and Vicinity) shows existing LOS and ICU values and estimated LOS and ICU values for intersections within the city of Lompoc. Inside the city of Lompoc, LOS values remain at A for all of the intersections evaluated. Therefore, project-related impacts would be insignificant.

For the intersection of Ocean Avenue and Union Sugar Avenue, the ICU and LOS were not measured, but a worst-case assumption was made based on traffic flow data. These data show a peak traffic flow of 400 vehicles per hour for Ocean Avenue (Highway 246) at "R" Street and 500 vehicles per hour for Central Avenue at "V" Street. For a worst-case scenario, all traffic was assumed to be traveling west with a constant flow until Central Avenue intersects Union Sugar Avenue, where traffic would turn left and follow Union Sugar Avenue to the Highway 246 intersection. The total number of vehicles at the Highway 246/Union Sugar Avenue intersection was assumed to be 900 vehicles over a one-hour period, based on peak traffic flow figures for Highway 246 and Central Avenue measured near their Union Sugar Avenue intersections. Similar intersections normally have a capacity of about 2,000 vehicles per hour. An ICU value was calculated to be 0.45, with a corresponding LOS of A. With the addition of traffic resulting from

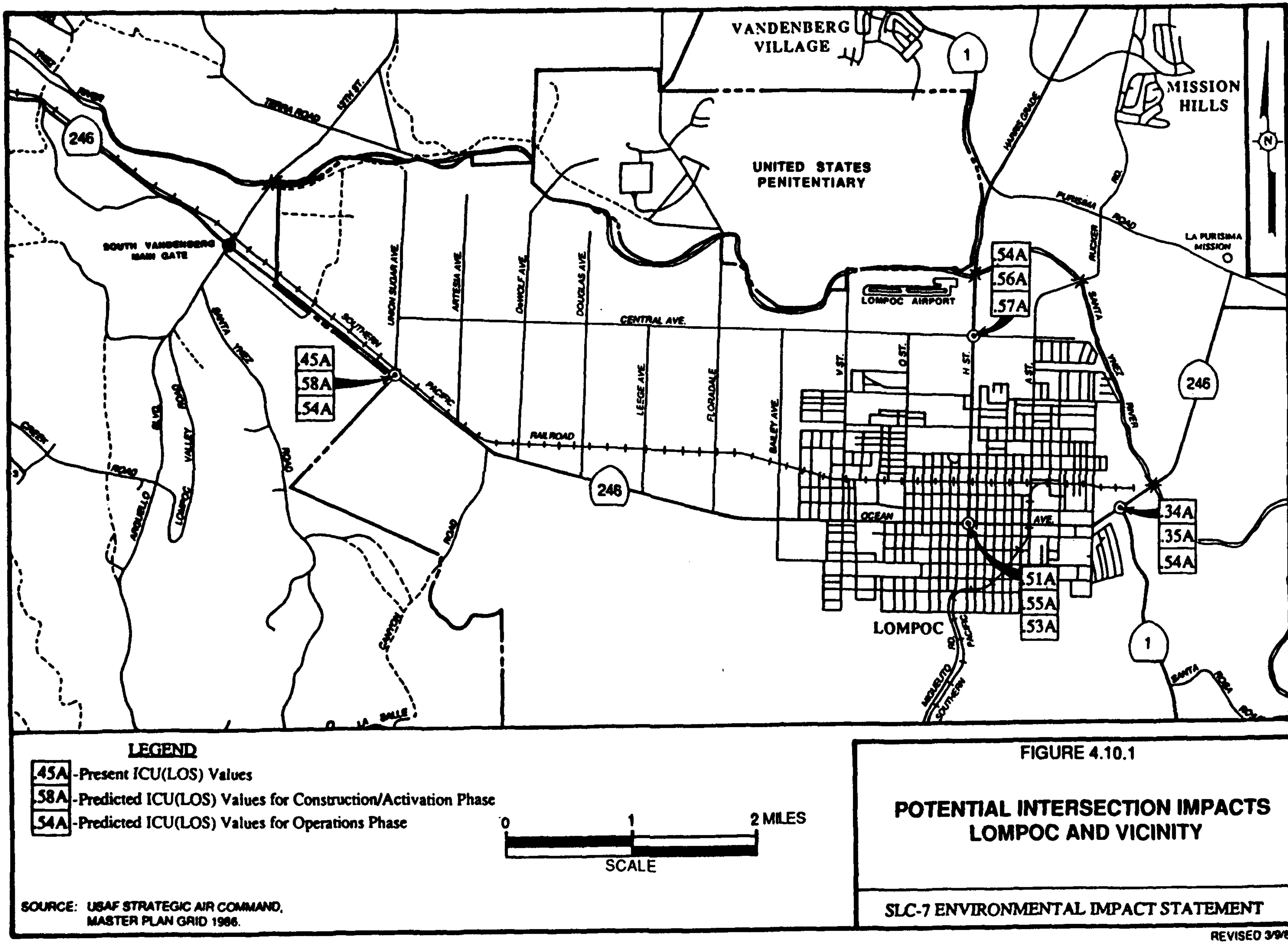

FIGURE 4.10.1

POTENTIAL INTERSECTION IMPACTS LOMPOC AND VICINITY

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implementation of the proposed action at one of the undeveloped sites, personnel vehicle flow at this intersection would increase by 250 for Construction/Activation and 180 for Operations phases. This increase in traffic would increase the ICU/LOS values to 0.58A and 0.54A for the Construction/Activation and Operations phases. The LOS of A extends to 0.60 (see Table 3.10.1).

The Main Gate entrance at VAFB normally allows traffic to flow through at a fairly even rate, with minimal delays occurring during peak hours. The maximum number of vehicles going through the gate in a one-hour period is about 2,200, measured between 4:00 and 5:00 p.m. (USAF 1987a). The most likely route to one of the four potential SLC-7 sites for those traveling from Santa Maria would be to enter VAFB at the Main Gate, then take 13th Street to the South Gate. The maximum percent increase in vehicles traveling through the Main Gate due to SLC-7 traffic from the Santa Maria area would be nine percent for Construction/Activation and seven percent for Operations. This small percent increase in the total number of vehicles traveling through the Main Gate could lead to additional delays in entering the gate, as some delays already occur. These impacts are not expected to be significant.

People living on VAFB would gain access to 13th Street from several locations. Once on 13th Street, personnel traveling to the project site would proceed to the 13th Street Gate, which intersects Highway 246 directly across from the South Gate entrance. Average daily traffic through the South Gate entrance is about 2,700 vehicles per day. The additional personnel for the proposed project is estimated to increase this amount by approximately 20 percent during peak construction. Presently, there are no delays when entering the South Gate. A 20 percent increase in vehicles moving through the gate could lead to short delays (USAF 1987a), but would not be significant.

4.10.2 LOCAL IMPACTS

Potential impacts to the transportation system due to traffic increases in the area of the Cypress Ridge, and alternative Boathouse Flats, and Vina Terrace sites would be the same during construction and operations. Potential impacts to the transportation system due to implementation of the proposed action at SLC-6 would be smaller during construction due to fewer personnel required. Potential impacts to the transportation system during operations at the SLC-6 site would be the same as the undeveloped sites. Traffic flow to this area of South VAFB is generally very low due to the lack of activity there. The increased project-associated traffic during peak hours could lead to slower average speeds along the roads leading to the site. Delays entering the site

area could also result if all of the traffic arrived within a short period of time. These impacts are considered to be insignificant for implementation of the proposed action at SLC-6 or one of the undeveloped sites.

4.10.3 CUMULATIVE IMPACTS

Cumulative impacts would result from the addition of traffic generated by the construction and operations phases of the proposed action to that already present on South VAFB related to operations at SLC-3 and SLC-4. There would be an increase in the number of vehicles utilizing both the South Gate and Coast Road. These additional vehicles could lead to slower overall speeds on the roads and delays in entering VAFB at the South Gate. However, traffic volumes on VAFB roadways are relatively low, so no significant impacts to the levels of service of the South VAFB roadways would be expected.

4.10.4 MITIGATION MEASURES

The USAF actively supports car pooling and staggered work hours. These programs would be available to personnel associated with the proposed project. Such measures would diminish peak traffic associated with traditional work starting and quitting times.

4.11 HEALTH AND SAFETY

Potential impacts to the health and safety of humans relative to the proposed project are addressed in this section. Health and safety impacts to other receptors are addressed in other sections, as appropriate (i.e., vegetation, wildlife). This section briefly explains the risk analysis process and the general procedure for creating scenarios that could result in environmental impacts.

Additionally, because a wide variety of possible impacts could result from activation of the proposed project, a separate Risk Assessment (Environmental Solutions 1989f) has been prepared. That report discusses potential impacts to health and safety and describes mitigation measures that would eliminate or greatly reduce the effect of such impacts.

For purposes of this discussion, potential impacts to human health and safety would be considered significant if one or more of the following were to occur:

- Creation of a potential public health hazard.
- Exposure of persons to toxic substances in excess of approved levels.
- Transport/handling of materials in a manner which exposes persons to unnecessary risk.
- Interference with emergency response or evacuation plans.

4.11.1 REGIONAL IMPACTS

Implementation of the proposed action may result in regional health and safety impacts due to construction, normal operations, and launch operations. These impacts would be similar if the proposed action were implemented at SLC-6 or any of the undeveloped sites. For discussion involving normal operations and launch operations, Table 4.11.1 (Potential for Adverse Effects from Normal Launch and Unscheduled Events) should be referred to for the probability of an accident to affect a specific receptor. The potential health and safety impacts of construction, operations, and unscheduled events relating to the regional environment are discussed in the following text.

4.11.1.1 Construction

Health and safety impacts related to construction of the proposed action are not anticipated to present a higher risk potential than what would be expected for similar types of projects.

TABLE 4.11.1

POTENTIAL FOR ADVERSE EFFECTS FROM NORMAL LAUNCH AND UNSCHEDULED EVENTS

EVENTS \ RECEPTORS	HUMANS	WILDLIFE	MARINE LIFE	EQUIPMENT AND STRUCTURES	STREAMS	OCEAN	SOILS	WILDLIFE HABITAT
NORMAL LAUNCH	○	○	○	○	○	○	○	○
LAUNCH ANOMALY	◉	●	●	●	●	●	●	●
SRMU TRANSPORTATION ACCIDENT	○	◉	○	◉	○	○	○	◉
SRMU HANDLING ACCIDENT	○	◉	○	◉	○	○	○	◉
HYPERGOLIC ACCIDENT	○	●	◉	●	◉	◉	◉	◉
CRYOGENIC ACCIDENT	○	◉	○	●	○	○	○	◉
PROPANE ACCIDENT	○	○	○	●	○	○	○	◉

PROBABILITIES

○ - LOW
◉ - MODERATE
● - HIGH

4.11.1.2 Normal Operations

Normal operations that could have a greater risk potential and, therefore, a regional impact would be those activities related to hypergolic propellant transportation/storage and/or transportation and preparation of the Solid Rocket Motor Upgrade (SRMU) segments.

Hypergolic Propellant Accidents

Hypergolic propellants such as hydrazine, unsymmetrical dimethyl hydrazine (UDMH), Aerozine - 50 (A-50), and nitrogen tetroxide (N_2O_4) are toxic. Nitrogen tetroxide, an oxidizer, exists in the atmosphere as a gas and is listed as a Class A poison. If involved in a fire, N_2O_4 would support combustion but would not explode. Hypergolic fuels such as hydrazine, UDMH, and A-50 are flammable liquids and burn easily in air. If vaporized, hypergolic fuels present an explosion hazard similar to propane, natural gas, or gasoline.

An accident (unplanned event) involving transportation of the hypergolic fuels to VAFB, or from the VAFB stockpile storage facility to the proposed Cypress Ridge or alternative sites, could result in the release of toxic gases to the atmosphere. Accidental rupture of the storage vessels due to an earthquake or lightning strike could result in a similar outcome. Shipping of hypergolic propellants to VAFB has occurred since 1958 and is regulated as specified in Section 3.11. Potential health and safety impacts would be minimal due to the low risk associated with accidents involving the trucks used to haul these propellants (see Section 3.11).

Shipments of propellants to support proposed operations would come from hypergolic fuel and oxidizer manufacturing plants in Mississippi and Alabama. The Titan IV/Centaur would require nine shipments of oxidizer and five shipments of fuel per launch or, at a launch rate of three per year, 27 shipments of oxidizer and 15 shipments of fuel. As discussed in Section 3.11, the accident rate for hypergolic propellant shipments is about 1.56 per one million round-trip vehicle miles traveled. At the hypergolic shipment rate needed for proposed operations, it would take more than seven years to travel one million round-trip miles.

SRMU Assembly Accident

SRMU segments are shipped to VAFB via railroad cars. Once at VAFB, they are placed in a facility for final processing before being moved to the launch complex for assembly. An accident during transportation to the processing facility, during handling at the processing facility, or

during transportation to the launch complex could result in ignition of the SRMU propellant. Such ignition would lead to a release of HCl, Al_2O_3, and heat, all of which could have adverse local health and safety impacts.

4.11.1.3 Launch Operations

The two types of launch operations that could impact the health and safety of the regional environment are a normal launch and a launch anomaly. Both would result in similar impacts to the regional environment, primarily involving HCl and Al_2O_3 emissions. In addition, a launch anomaly could result in release of hypergolics to the atmosphere and subsequent deflagration/explosion. The SLC-7 Risk Assessment (Environmental Solutions 1989f) discusses possible impacts to humans in detail.

4.11.2 LOCAL IMPACTS

4.11.2.1 Cypress Ridge

The construction and operation of the proposed action at South VAFB could result in health and safety impacts to the local environment due to initial construction, normal operations, and launch operations. Table 4.11.1 shows the relationship between normal launch and unscheduled events and their probability of impacting certain receptors. Reference should be made to Table 4.11.1 during the following discussion.

Construction

Construction of the proposed action would not add the potential for significant health or safety impacts to the local environment. The potential for normal impacts, as associated with other types of major facility construction, would be present.

Normal Operations

Adverse impacts could occur during normal operations due to an accident involving one of the following activities or materials:

- SRMU assembly.
- Hypergolic propellants.
- Cryogenic propellants.
- Propane storage facilities located on the site.

SRMU Assembly Accident

Accidents during SRMU assembly could be caused by mishandling of the SRMU segments. Handling accidents could occur due to a malfunction of the assembly crane or human error, the outcome being possible ignition of the propellant. Propellant ignition would result in the release of HCl, Al_2O_3, and heat. HCl gas can be toxic to humans and wildlife, and heat released can be damaging to equipment, humans, and wildlife. Al_2O_3 is present as a dust, which could cause respiratory ailments in humans and wildlife. Any of these outcomes could adversely impact the local environment.

Hypergolic Propellant Accidents

Hypergolic propellant accidents could occur during transfer from the transport vehicle to the Ready Storage Vessel (RSV), during storage in the RSV, during transfer from the RSV to the launch vehicle storage tanks, or due to failure of the hypergolic vapor removal system. Accidents occurring during storage transfer could be caused by either malfunctioning equipment or human error. An accidental rupture of an RSV also could be caused by a natural disturbance, such as an earthquake or lightning strike. Hypergolic vapors are generated during transfer and are destroyed by either incineration or scrubbing. If the incinerator/scrubber failed, hypergolic vapors would be released to the atmosphere. The effect of an accident involving hypergolic propellants would be release of a toxic substance into the atmosphere and the possibility of a fire/explosion, both of which could have adverse local impacts.

Cryogenic Propellant Accidents

Under certain conditions, cryogenic propellants can be explosive. Liquid oxygen is used as an oxidizer and readily supports combustion of any fuel. However, it presents an explosion hazard only if it comes in contact with a combustible material (ignition source). Gaseous oxygen presents a similar explosion hazard. Liquid hydrogen, a highly flammable liquid, presents an extreme fire hazard and is easily ignited. If hydrogen and air mix in an unconfined area, they will burn rapidly

if ignited. A confined mixture of hydrogen and air may explode if ignited. Possible accidents could occur during storage tank filling, due to a rupture in the storage tank, or during transfer from the storage tanks to the launch vehicle storage tanks. Potential causes of such accidents would be similar to those for the hypergolic fuels. The outcome of a major leak of cryogenic propellants could be a fire/explosion, which could have adverse impacts.

Propane Storage Accidents

There could be an accident related to propane storage, with the potential for fire or explosion. Either fire or explosion could have adverse impacts to local health and safety.

Launch Operations

There are two possible vehicle launch scenarios: (1) normal launch, and (2) launch anomaly.

Normal Launch

Normal launch of a Titan IV/Centaur would result in emissions of HCl and Al_2O_3 due to solid rocket ignition. Also present would be a large amount of water vapor due to evaporation of the deluge water used to cool the exhaust duct. A launch abort is considered a normal procedure. The abort sequence is programmed for an "environmentally safe" condition.

The exhaust ground cloud, comprised of HCl, Al_2O_3, and water vapor, also may contain hydrochloric acid, produced by the reaction of HCl and water vapor. Adverse impacts to health and safety could result from exposure in excess of threshold limit values (TLVs) to any of the components in the ground cloud. Exposure of uncontrolled populations to levels of HCl and Al_2O_3 above their respective TLVs would be prevented through utilization of launch safety procedures (i.e. Toxic Hazard Corridor generation). Further, results of laboratory studies indicate that there is no cumulative effect from repeated doses of low levels of HCl and Al_2O_3 (Sax and Lewis 1989), as typically found in the ground cloud of a space vehicle launch. The SLC-7 Risk Assessment contains detailed discussions of possible impacts to humans.

Launch Anomaly

Many of the effects of a launch anomaly would be similar to those of a normal launch. A ground cloud also would form during a launch anomaly, but could possibly contain hypergolic propellant

residues. Also, there would be the possibility of an explosion, with the potential for destruction of property and fire damage to the surrounding area. Impacts of a launch anomaly would be similar to those of a normal launch, but potentially more severe.

4.11.2.2 SLC-6

The majority of construction and operational health and safety impacts created by implementation of the proposed action at the SLC-6 alternative would be the same as those at Cypress Ridge. However, one additional potential health and safety impact would be created during construction. This impact relates to flushing of the present hypergolic fuel and oxidizer system with a [illegible]ud chemical. This activity would require implementation of techniques and procedures for handling hazardous materials which, if followed, would result in no significant impact to the local health and safety environment.

Other impacts for the alternative SLC-6 site would be comparable to those described for the proposed Cypress Ridge site.

4.11.2.3 Boathouse Flats

Impacts at the Boathouse Flats site would be similar to those at Cypress Ridge.

4.11.2.4 Vina Terrace

Impacts at the Vina Terrace site would be similar to those at Cypress Ridge.

4.11.3 CUMULATIVE IMPACTS

Cumulative impacts will be discussed in relation to both the regional and local environments. The greatest possibility for adverse and significant impacts may exist during propellant transfer/transportation, SRMU handling/transportation, and launch operations. These impacts would be the same for the SLC-6 and undeveloped sites since operations would not vary greatly.

The cumulative number of hypergolic propellant transfers to SLC-4E, SLC-4W, and SLC-7 would be 37 fuel shipments and 63 oxidizer shipments per year to VAFB from manufacturing plants in Mississippi and Alabama. The accident ratio would be 1.56 accidents per one million vehicle round trip miles. At the cumulative rate of propellant delivery, it would take about three years for

one million round trip miles to be traveled. The cumulative impact to health and safety would consist of a slightly greater chance that a truck carrying a hypergolic propellant would become involved in an accident. If an accident did occur, it would not necessarily cause a spill or leak of hypergolic propellant because of the special construction of the tanker vessels. However, a worst-case event could result in a significant local or regional health and safety impact.

Titan IV/NUS operations are also being planned for SLC-4 starting in 1990, with approximately two to three launches per year. The additional launches created by the activation of SLC-7 (about three per year) would increase, to some extent, the potential for an impact to affect the health and safety of the environment. The potential for these events to occur can be minimized by using existing safety regulations contained in WSMCR 127-1 and 1STRADR 127-200. Further explanation of both of these regulations is in Section 3.11.2.

4.11.4 MITIGATION MEASURES

4.11.4.1 Risk Assessment

In order to include the wide range of possible health and safety impacts to the regional and local environments, a risk assessment for the proposed project was performed (Environmental Solutions 1989f). Possible accident scenarios were considered, and then an analysis was conducted of present safety measures incorporated into normal operations of a launch complex on VAFB. From this analysis, it was determined that the present safety measures were sufficient to mitigate potential risk to the public health and safety from implementation of the proposed action at the proposed or alternative sites. A brief explanation of the risk analysis process is provided below.

Each scenario must have an initiating event that can be either a normal or an unscheduled launch occurrence. Because of the nature of the events, each one could lead to multiple outcomes. Because a wide range of possibilities exists, a systematic procedure was used to develop the risk assessment scenarios. A scenario was considered to be comprised of the following five elements:

- An event that triggers one or more outcomes.
- An outcome that could result from one or more triggering events and leads to one or more pathways by which the outcome could result in hazardous or damaging conditions for human populations, property, or other aspects of the environment.

- A pathway associated with one or more outcomes, by which the potentially harmful effects reach either human populations or the environment.

- Receptors of the effects, via pathways consisting of mechanisms by which human populations or the environment are exposed to the outcome(s) of an event.

- Consequences for the human populations, property, or other aspects of the environment.

A complete scenario starts with an event that leads to one or more outcomes, pathways, receptors, and consequences. Each event, outcome, pathway, receptor, and consequence is comprised of multiple parts. The scenario development path and the items considered in developing an individual scenario are shown in Figure 4.11.1 (Risk Assessment Scenario Development).

For the purpose of the risk assessment discussed herein, the triggering events were determined to be:

- Normal Launch.
- Launch Anomaly.
- SRMU Transportation Accident.
- SRMU Handling Accident.
- Hypergolic Accident.
- Cryogenic Accident.
- Propane Accident.
- High-Pressure Gas Accident.
- Fire.

The receptors are the affected elements in the scenario scheme. For this risk assessment, these receptors were determined to be:

- Humans.
- Wildlife.
- Marine Life.
- Equipment and Structures.
- Streams.
- Ocean.
- Soils.
- Wildlife Habitat.

Every event has a probability of affecting a receptor. For ease of understanding, these probabilities have been categorized as low, medium, and high. Table 4.11.1 shows the probabilities of the scenario events affecting a receptor. The Risk Assessment (Environmental Solutions 1989f) presents each of the probabilities in a more quantitative manner.

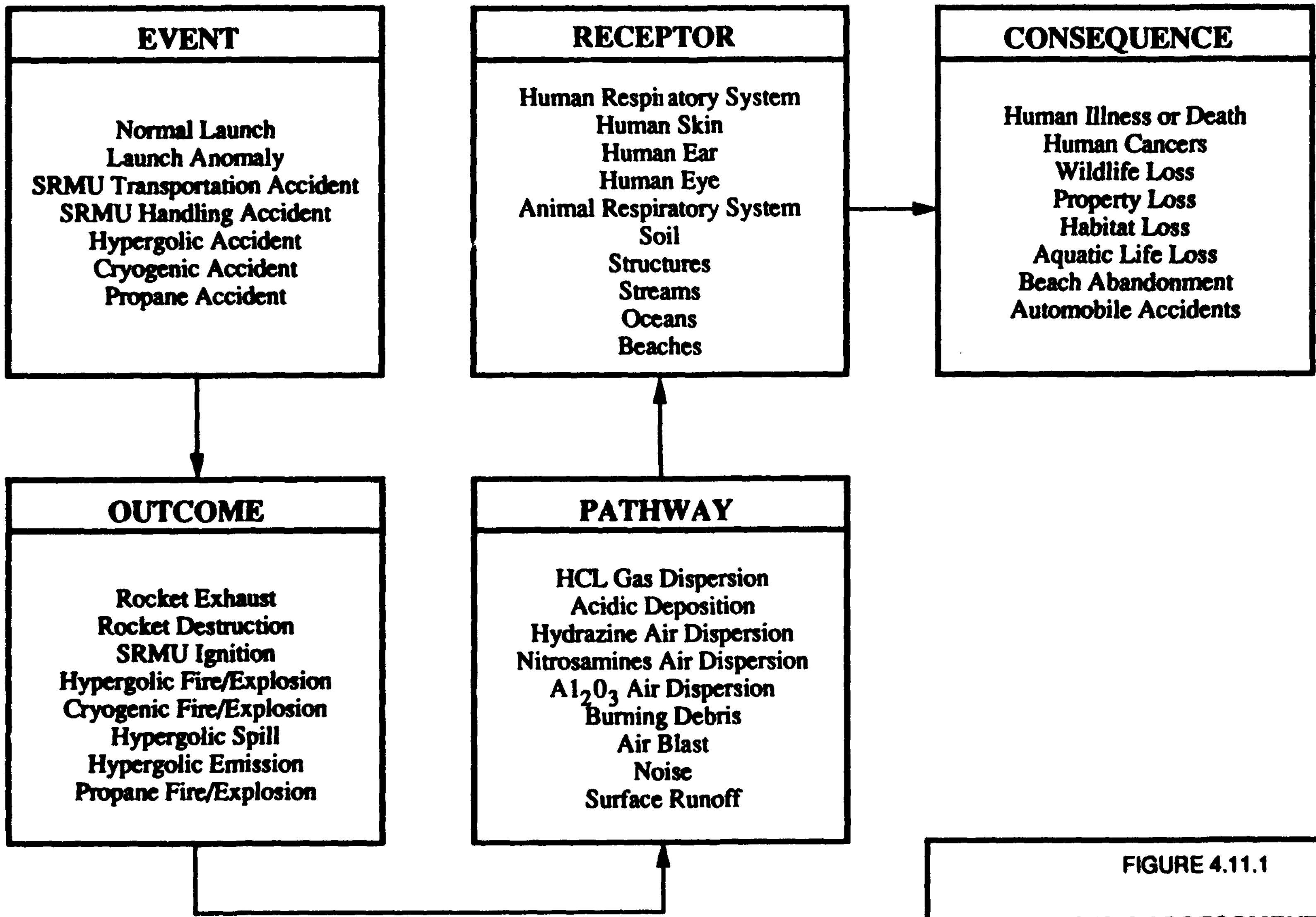

FIGURE 4.11.1

RISK ASSESSMENT SCENARIO DEVELOPMENT

SLC-7 ENVIRONMENTAL IMPACT STATEMENT

4.11.4.2 Cypress Ridge

As found by the outcome of the SLC-7 Risk Assessment, no new mitigation measures are needed for the Cypress Ridge site.

4.11.4.3 SLC-6

As mentioned in Section 4.6, the construction contractor would be required to develop a waste management plan as a mitigation measure.

4.11.4.4 Boathouse Flats

No mitigation measures are proposed for the project at the Boathouse Flats site.

4.11.4.5 Vina Terrace

No mitigation measures are proposed for the project at the Vina Terrace site.

4.12 SOCIOECONOMICS

Assessment of the potential socioeconomic impacts of the proposed project are based on a number of assumptions, primarily that construction employment at SLC-6 would be less than at the three undeveloped sites. Many of the major facilities are present at SLC-6 and would require modifications rather than new construction. Operations (long-term) employment would be the same for all four potential site locations. Additional assumptions include the subsequent effects to population and the demand for housing and services. Direct impacts are those associated with the project, such as the expenditures and housing requirements of workers. Indirect impacts include the expenditures and needs of workers whose jobs are created by direct SLC-7 expenditures in the local communities.

The potential housing and public service impacts created by construction and operations employment would vary depending on the number of new jobs filled by the existing labor force in Santa Barbara County. Existing residents would not generate additional demands for housing and public services. The number of persons in the existing county labor force who may be employed by the proposed project cannot be predicted with certainty. A number of factors would affect local labor availability for proposed project employment, such as the need for persons with particular work skills, other projects at VAFB requiring a similar labor force, and labor demands of oil and gas companies. In order to describe the full range of possible socioeconomic impacts, this assessment assumes that direct construction and operations employment for the proposed action would be filled by persons entering the region as new residents.

Anticipated project-related indirect employment impacts are based on estimated contract employee salaries and on- and off-base wages for permanent military employees. Indirect jobs were assumed to occur in either the Lompoc Valley (25 percent) or Santa Maria Valley (75 percent) (USAF 1987c). Potential household growth caused by indirect employment was adjusted for increases associated with secondary workers residing in direct employment households. In other words, many of the households of construction and operations workers would include another person seeking employment (a secondary worker). These secondary workers would be able to fill jobs in the retail and service industries (SBCCAPC 1985). The potential household growth caused by indirect employment would be the difference between total indirect employment and the number of secondary workers in direct employment households.

An identified socioeconomic impact would be considered significant if it were to result in one or more of the following:

- Substantial growth or concentration of population.
- Displacement of a large number of people.
- The need for substantial new housing.
- The need for additional utilities distribution facilities.
- Shortages in public supply of water, energy, and/or services.

4.12.1 REGIONAL IMPACTS

4.12.1.1 Cypress Ridge

Employment

Construction

Project construction is planned to occur from 1990 to 1994. The number of construction workers would range from 100 to 550 workers, with an average of 370. A maximum of 550 would be onsite between 1991 and 1992 (see Figure 2.1.9). Associated indirect employment is estimated to be about 150.

Operations

Operations of the proposed project at Cypress Ridge would generate about 400 employment positions, anticipated to be comprised of about 90 Air Force personnel and 310 civilian contract employees. Expenditures of the proposed project military and civilian work force would generate an estimated 165 indirect jobs based on a multiplier of 0.41 (USAF 1988b). These jobs primarily would be in retail and services industries. Given the present concentration of retail activity in North County, the majority of indirect employment would occur in the Santa Maria Valley, with the remainder in the Lompoc Valley.

Population

Construction

A short-term increase in population would occur as a consequence of project construction at Cypress Ridge. At present, county surveys have shown that, for each 100 industry workers, there are approximately 55 additional persons (e.g., spouses, dependents) that are part of their households (SBCCAPC 1985). Based on this ratio, proposed project construction activity would

generate a population increase of approximately 850 persons between 1991 and 1992, the peak construction years. Assuming that residential choice decisions of construction workers would be similar to current oil and gas industry workers, the majority (60 percent) of short-term proposed project-related population impacts would occur in the Lompoc Valley, with the remainder in the Santa Maria Valley, Santa Ynez Valley, and the South Coast area of Santa Barbara County.

Operations

Operations at the proposed project at Cypress Ridge are estimated to generate an additional population of approximately 1,470 persons and about 565 additional households in the general community as a consequence of direct (400 households) and indirect (165 households) employment. Approximately 865 persons living in the Lompoc Valley in 1995 are expected to be related to SLC-7 direct and indirect employment. This would be less than one percent of the projected 1995 Lompoc Valley population. An estimated 550 persons living in the Santa Maria Valley in 1995 could be related to direct and indirect SLC-7 employment. This population is an increase of 0.5 percent above the projected 1995 population in the Santa Maria Valley (SBCCAPC 1985). Estimated SLC-7 related 1995 population in the Santa Ynez Valley and San Luis Obispo County (55 persons) would be less than 0.1 percent of the projected population for 1995.

Housing

Construction

Short-term housing impacts could be generated by the proposed project. Beginning in 1990, the proposed project would generate an average annual demand for approximately 205 housing units, increasing to about 305 during peak construction activities. The housing estimates are based on current oil and gas industry patterns of about 1.8 construction workers per household (SBCCAPC 1987a). The majority of short-term housing demand (approximately 125 units, increasing to 190 during peak construction) would be for permanent units such as single-family homes and apartments. Temporary units, such as hotel and motel rooms, would comprise the remainder. This demand would be concentrated in the Lompoc area, where 60 percent of construction workers would be expected to reside; the remainder would occur in the Santa Maria and Santa Ynez Valleys and the South Coast area. Present vacant housing in the cities of Lompoc and Santa Maria (approximately 1,400 dwellings) is substantially higher than the anticipated project-related housing needs during the construction period (California Department of Finance 1988).

Operations

Beginning about 1994, proposed project employees would be expected to generate a demand for an estimated 165 housing units in the Lompoc Valley and 150 housing units in the Santa Maria Valley. Given the comparatively high average incomes of contract employees ($45,220 in 1987) and off-base military personnel ($27,650 in 1987), it is anticipated that housing demand primarily will be for single-family dwellings, which are expected to continue to comprise the largest share of the housing supply in these areas. The supply of low-density residential land in Lompoc Valley generally appears adequate to meet anticipated project-related demand, although other factors, such as South Coast commuters, could affect this supply. The Santa Maria Valley has an ample supply of developable land zoned for low-density residential use to accommodate future needs (SBCCAPC 1987a).

Public Utilities and Facilities

Construction

The construction work force at the Cypress Ridge site and resulting indirect employment would have short-term impacts on some public services and utilities in Santa Barbara County. Table 4.12.1 (Construction Employment, Public Service Impacts) shows the public service impacts that would be created during peak construction. During peak construction between 1991 and 1992, project-related households could increase requirements for police officers and fire fighters by three, local school enrollment by 290 students, daily sewage wastewater flows by 100,800 gallons, annual water usage by 287 acre-feet, and solid waste generation by 2,299 tons per year. The majority of this demand is anticipated to occur in the Lompoc area. For most public services, the short-term population impacts of proposed Cypress Ridge construction employment would not result in significant reductions in the level of services. However, off-base water demand is anticipated to contribute to increased overdraft of ground water resources in North County communities (see Section 4.2).

Operations

The anticipated increase in the need for public services and utilities resulting from proposed project operations is slightly greater than that for construction, as shown in Table 4.12.2 (Operations Employment, Public Service Impacts). These public service requirements would represent less than one percent of the anticipated demand to be generated by the 1995 population in the North County communities. Increases of two police officers and two fire fighters could be expected due to operations. Additional increases would be 297 more students in the local schools, an additional 305 acre-feet of water per year being used, an additional 102,900 gallons per day of sewage

TABLE 4.12.1

CONSTRUCTION EMPLOYMENT PUBLIC SERVICE IMPACTS (1)

	PUBLIC SERVICE MULTIPLIERS (2)				ADDITIONAL RESIDENTS				PUBLIC SERVICE IMPACTS				TOTAL
	LOMPOC		SANTA MARIA	OTHER	LOMPOC		SANTA MARIA	OTHER	LOMPOC		SANTA MARIA	OTHER	
	INC.	UNINC.(3)			INC.	UNINC.(3)			INC.	UNINC.(3)			
Police Officers	0.0015	0.00146	0.00118	0.00146	430/ 235	420/ 230	525/ 290	65/ 35	0.65/ 0.36	0.61/ 0.34	0.62/ 0.31	0.09/ 0.05	1.97/ 1.09
Fire Fighters	0.0009	0.00117	0.0006	0.00117	430/ 235	420/ 230	525/ 290	65/ 35	0.39/ 0.21	0.49/ 0.27	0.32/ 0.18	0.08/ 0.04	1.28/ 0.7
School Enrollment	0.219	0.219	0.185	0.107	430/ 235	420/ 230	525/ 290	65/ 35	94/ 52	92/ 51	97/ 53	7.0/ 3.9	290/ 160
Water Use (Urban)(4)	0.14	0.24	0.21	0.24	430/ 235	420/ 230	525/ 290	65/ 35	60/ 33	101/ 56	110/ 61	16/ 9	287/ 159
Sewage Treatment (5)	70	70	70	70	430/ 235	420/ 230	525/ 290	65/ 35	30,100/ 16,555	29,400/ 16,170	36,750/ 20,213	4,550/ 2,503	100,800/ 55,441
Solid Waste Disposal (6)	1.4	1.4	1.9	1.7	430/ 235	420/ 230	525/ 290	65/ 35	602/ 331	588/ 323	998/ 549	111/ 61	2,299 1,264

(1) Cypress Ridge/SLC-6. Impacts related to SLC-6 assumed to be approximately 55 percent of those for Cypress Ridge. Numbers for Boathouse Flats and Vina Terrace would be the same as for Cypress Ridge.
(2) Multiplier units are per resident.
(3) Includes VAFB, Mission Hills, Vandenberg Village.
(4) Acre-feet per year.
(5) Gallons per day.
(6) Tons per year.

Source: Santa Barbara County 1987.

TABLE 4.12.2

OPERATIONS EMPLOYMENT PUBLIC SERVICE IMPACTS

	PUBLIC SERVICE MULTIPLIERS[1]				ADDITIONAL RESIDENTS				PUBLIC SERVICE IMPACTS				TOTAL
	LOMPOC		SANTA MARIA	OTHER	LOMPOC		SANTA MARIA	OTHER	LOMPOC		SANTA MARIA	OTHER	
	INC.	UNINC.[5]			INC.	UNINC.[5]			INC.	UNINC.[5]			
Police Officers	0.0015	0.00146	0.00118	0.00146	315	550	550	55	0.47	0.80	0.65	0.08	2.0
Fire Fighters	0.0009	0.00117	0.0006	0.00117	315	550	550	55	0.28	0.64	0.33	0.06	1.31
School Enrollment	0.219	0.219	0.185	0.107	315	550	550	55	69	120	102	6	297
Water Use (Urban)[2]	0.14	0.24	0.21	0.24	315	550	550	55	44	132	116	13	305
Sewage Treatment[3]	70	70	70	70	315	550	550	55	22,050	38,500	38,500	3,850	102,900
Solid Waste Disposal[4]	1.4	1.4	1.9	1.7	315	550	550	55	441	770	1,045	93.5	2,349.5

(1) Multiplier units are per resident.
(2) Acre-feet per year.
(3) Gallons per day.
(4) Tons per year.
(5) Includes VAFB, Mission Hills, Vandenberg Village.

Source: Santa Barbara County 1987.

wastewater being generated, and 2,350 more tons of solid waste. Project-related service demand increases could generate a need for additional staffing of some public services in communities such as Lompoc that may absorb the largest share of this growth.

Regional electrical demand would increase as a result of SLC-7 requirements, estimated to be about 8,000 kVA. Current average electrical demand for the interconnected system supplying the region is about 15,000 MVA. The additional requirements of SLC-7 would result in an approximate 0.04 percent increase in average annual demand from the grid. Current peak demands generally are to 18,000 MVA, about 20 percent over average demand. The addition of SLC-7 annual and peak requirements would use only a small portion of the available electricity in the PG&E interconnected system and would not be significant.

Economic Resources

Wages and Salaries

The economic impacts of the proposed action are anticipated to be in the form of an increase in the regional money supply as a result of expenditures for housing, goods, and services. Such expenditures would be made by construction and operations personnel (direct impacts) and by those in additional jobs created as a result of the "ripple" effect of proposed project employment (indirect impacts). During project construction, most of the expenditures would be made by construction workers, consisting of either existing residents related to construction activities in the oil and gas industry or new workers in the area specifically for the proposed project. The extent to which expenditures by construction workers are additive to the existing economic situation would depend primarily on the number of new construction workers in the area.

Due to the specialized nature of the project, it is anticipated that all military and civilian operations personnel would move to the area from outside and establish new permanent residences. For purposes of this analysis, the economic impacts are based on the population assumptions previously addressed in Section 4.12.1.2 (i.e., that all construction and operations employees would be new to the area).

For both construction and operations phases of the project, there would be a mix of military and civilian personnel. However, all of the resulting indirect employment is anticipated to be civilian.

It is anticipated that salaries would average approximately $16,730 per year for military personnel living on-base and $27,650 for off-base military personnel. Salaries of civilian construction

workers would be approximately $36,500 per year. For civilian personnel, plus military personnel living off-base, approximately 50 to 55 percent of salaries would stay in the Lompoc-Santa Maria-Santa Barbara region. For military personnel living on VAFB, approximately 30 percent of their wages would stay in the region. This is estimated to be a maximum of $9.41 million annually for the construction period (see Table 4.12.3, Wage and Salary Contribution to Regional Impact Area).

For project operations, it is anticipated that about $8.3 million annually would stay in the regional economy for the duration of activities at Cypress Ridge.

Services and Materials

VAFB contracts out for services such as cleaning, catering, and general maintenance from the surrounding communities. Of $8.2 million dollars spent in 1987 on services by VAFB, about $3.9 million went directly into the local impact region. Approximately 50 percent of the $3.9 million was spent in the Lompoc area and 26 percent in the Santa Maria Area. The remaining 24 percent was spent in other regions throughout Santa Barbara and San Luis Obispo Counties. Materials, equipment, and supplies purchased by VAFB in 1987 amounted to about $1.95 million dollars, all of which was spent in the impact region. Similar ratios would be expected to influence the amount of money Cypress Ridge construction and SLC-7 operations would bring into the regional impact area from services and materials purchased.

Types of materials that could be purchased in the region would be items such as cement, aggregate, lumber, and other routinely used construction material. Additional equipment and supplies would be brought into the region by the contractors responsible for aerospace equipment installation. This equipment would include items such as computers, pre-assembled launch towers and platforms, and "exotic" types of wiring and other materials needed in the specialized construction.

4.12.1.2 SLC-6

Employment

Construction

Project construction is planned to occur from 1990 to 1994. The number of construction workers would range from 100 to 300, with an average of about 200. A maximum of 300 would be onsite between 1991 and 1992. Associated indirect employment is estimated to be about 80.

TABLE 4.12.3

ESTIMATED ANNUAL WAGE AND SALARY CONTRIBUTION TO REGIONAL IMPACT AREA (RIA)

	NUMBER OF WORKERS (MAXIMUM)	AVERAGE ANNUAL SALARY/WAGE	PERCENT OF PAYROLL SPENT IN REGIONAL IMPACT AREA (RIA)	ANTICIPATED ANNUAL CONTRIBUTION TO RIA[1]
CONSTRUCTION PERSONNEL[1]	550/300			
Civilian	430/235	$36,500	55	$8,630,000/ $4,746,500
Military				
- On-base	100/55	$16,730	30	$502,000/ $276,100
- Off-base	20/11	$27,650	50	$277,000/ $152,350
OPERATIONS PERSONNEL[2]	400			
Civilian	310	$45,220	55	$7,710,000
Military				
- On-base	70	$16,730	30	$351,000
- Off-base	20	$27,650	50	$277,000

(1) Cypress Ridge/SLC-6. Numbers for Boathouse Flats and Vina Terrace would be approximately the same as Cypress Ridge.

(2) Operations personnel would be the same for the four potential sites.

Source: USAF 1987b.

Operations

Operations impacts would be the same as for the proposed Cypress Ridge site.

Population

Construction

There would be a short-term increase of about 465 persons during peak SLC-6 construction between 1991 and 1992. This is about 55 percent of the 850 anticipated to result from construction at the proposed Cypress Ridge site. Residential patterns are assumed to be the same as for construction at Cypress Ridge, although the number of persons involved would be considerably less.

Operations

Operations impacts at the SLC-6 alternative would be the same as those for the proposed Cypress Ridge site.

Housing

Construction

Short-term housing requirements resulting from construction at SLC-6 would be an average annual demand of about 110 units and peak construction demand of about 165 units. Most of this demand would be for permanent units, averaging about 70 and peaking at about 100. This demand is considerably less than anticipated demand related to construction at the proposed Cypress Ridge site. Housing patterns are expected to be the same as for construction at the proposed Cypress Ridge site.

Operations

Housing impacts related to operations at SLC-6 would be the same as for the proposed Cypress Ridge site.

Public Utilities and Facilities

Construction

The construction work force at SLC-6 and resulting indirect employment would have short-term impacts on some public services and utilities in Santa Barbara County. Overall, these impacts are expected to be smaller than those which would occur relative to the Cypress Ridge site (see

Table 4.12.1). Peak construction is expected to increase requirements for police and fire fighters by two, local school enrollment by 160 students, daily sewage wastewater flows by approximately 55,400 gallons, annual water usage by about 159 acre-feet, and solid waste generation by about 1,300 tons per year. Most of these impacts would occur in the Lompoc area, but would not be significant, due to existing excess capacity. However, the increase in off-base water demand, although relatively small, would contribute to an existing overdraft of ground water (see Section 4.2).

Operations

Operations impacts would be the same as for the proposed Cypress Ridge site..

Economic Resources

Wages and Salaries

The pattern of spending of construction wages and salaries would be the same as for the proposed Cypress Ridge site. However, the total amounts would be considerably less, as the SLC-6 construction work force is anticipated to be smaller than the work force for the Cypress Ridge site. Based on a smaller construction work force, total wages and salaries are expected to reach a maximum of $5.18 million annually (see Table 4.12.3).

Project operations would be the same as Cypress Ridge, with an estimated $8.3 million annual contribution to the regional economy.

Services and Materials

The economic impact of services and materials is expected to have the same distribution as with the proposed action at Cypress Ridge. However, impacts from construction at SLC-6 would be about one-half of those from construction at the Cypress Ridge site due to the presence of existing facilities at the site.

Operations impacts at SLC-6 would be the same as those for the proposed action at Cypress Ridge.

4.12.1.3 Boathouse Flats

Regional socioeconomic impacts from the proposed action at Boathouse Flats would be approximately the same as those for the proposed Cypress Ridge site.

4.12.1.4 Vina Terrace

Regional socioeconomic impacts from the proposed action at Vina Terrace would be approximately the same as those for the proposed Cypress Ridge site.

4.12.2 LOCAL IMPACTS

4.12.2.1 Cypress Ridge

Employment

The maximum labor force requirement of the proposed project at Cypress Ridge during construction is expected to be about 550 workers. The operations work force would generate a maximum of 400 permanent positions, comprised of an estimated 90 Air Force personnel and 310 civilian contract employees. Operations would result in an increase over 1987 employment at VAFB, as military/civil service employment would increase approximately 1.5 percent, and contractor employment would increase about 6.2 percent. The overall increase would be about 3.5 percent.

Population

The 310 civilian employees and 20 of the 90 military employees are expected to live off-base. Current military dependent to military personnel ratios (1.65 dependents to 1 personnel) for VAFB suggest that VAFB population could increase by 186 persons in 1995 as a consequence of SLC-7 operations.

Housing

Presently there are approximately 200 vacant family housing units and more than 700 available spaces in dormitories on base. VAFB staff projections through 1992 do not anticipate a significant increase in the number of military personnel assigned to the base. Therefore, it is not anticipated that SLC-7 operations would significantly impact on-base housing resources.

Utilities and Services

On base employment and population would remain substantially below past levels after initiation of operations at SLC-7. Therefore, the proposed project is not expected to significantly impact design capacities of existing VAFB utilities and services.

During operations, the electrical demand of SLC-7 would average about 5,200 kVA, with peaks to 6,000 kVA. The power grid that supplies electricity to VAFB has a capacity of 92.5 MVA, an operating demand which averages about 42 MVA, and peak requirements of approximately 52 MVA. The addition of SLC-7 to the VAFB power grid would result in an increase of about 12 percent over existing average demand. With this increase, the total annual and peak demand on the grid would remain at about 50 percent of its overall capacity. Therefore, the impact related to SLC-7 would not be considered significant.

4.12.2.2 SLC-6

Employment

The maximum labor force requirement of the proposed action at the SLC-6 site during construction is expected to be about 300 workers, significantly less than the maximum 550 anticipated for project implementation at one of the three undeveloped sites. The operations work force would be a maximum of 400, the same as for the Cypress Ridge site.

Local operations effects relative to population, housing, and utilities; and services would be the same as for project development at the proposed Cypress Ridge site and, therefore, would not be significant.

4.12.2.3 Boathouse Flats

The socioeconomic impacts of the Boathouse Flats alternative would be the same as those described for the proposed Cypress Ridge site.

4.12.2.4 Vina Terrace

The socioeconomic impacts of the Vina Terrace alternative would be the same as those described for the proposed Cypress Ridge site.

4.12.3 CUMULATIVE IMPACTS

4.12.3.1 Cypress Ridge

Construction

SLC-7 construction work force requirements may have a cumulative impact on the construction labor market in Santa Barbara County. The maximum annual Cypress Ridge construction labor requirements would be comparable to ten percent of the impact of oil and gas industry construction (CSBRMD 1988).

Construction employment could have a short-term cumulative impact on the share of population, growth, and increased housing and public services needs in Santa Barbara County attributable to the influx of construction workers; this impact would comprise a 25 percent increase above present construction-related population, housing, and public services impacts (CSBRMD 1988). These impacts would occur primarily in North County communities, especially Lompoc and Santa Maria.

However, the cumulative impact of construction labor needs may be attenuated if the project can draw from the existing pool of skilled construction labor in the Santa Barbara County/San Luis Obispo County region. County projections anticipate a decrease in construction labor in the two-county region after 1987, when 11,500 construction workers were employed for oil and gas projects in the completion stages (CSBRMD 1988). Between 1987 and 1988 in Santa Barbara County, oil-related construction employment was expected to decrease by approximately 800 jobs, which exceeds the peak annual work force requirements of the SLC-7 project at Cypress Ridge (550 workers). Since the majority of oil-related construction employment has located in the Lompoc, Santa Ynez, and Santa Maria Valleys, there may be a local surplus of construction workers. Therefore, the proposed project may help maintain construction employment opportunities for workers currently living and working in the county, rather than generate a net employment increase.

The extent to which construction labor needs are met by existing county residents would offset potential cumulative short-term impacts on housing and public services and utilities. The number of local residents hired for project construction would lessen the potential need for additional housing and public services. This also would prolong the present housing and public service impacts begun by oil- and gas-related construction workers.

Operations

The SLC-7 operations work force could have a cumulative impact on the need for additional housing and public services in the Lompoc Valley. Based upon projected population and economic growth in Santa Barbara County, anticipated year 2000 housing demand in the city of Lompoc could exhaust the current supply of land, particularly for lower-density (single-family residential) housing types (SBCCAPC 1987a). Should a residential land short-fall occur, future development could be redirected to other areas, such as the Santa Maria Valley, or pressure could increase for rezoning non-urban land in Lompoc Valley.

Cumulative level-of-service impacts to public services and utilities within the Lompoc and Santa Maria Valleys are not considered significant. Although potable water sources are not considered a constraint to future development at this time, an increase in the current overdraft of ground water supplies in northern Santa Barbara County could change this situation. Should the availability of water require limits on its use in the near future, project-related housing and population growth could be significant relative to water demand in the region.

4.12.3.2 SLC-6

Construction requirements for the proposed project at SLC-6 may have a cumulative effect on the construction labor market in Santa Barbara County. The maximum annual SLC-6 construction labor requirements would be comparable to about five percent of that of the oil and gas industry. Construction employment could have a short-term cumulative impact relative to population, growth, and housing and public services needs of incoming construction workers. This impact could provide a 14 percent increase to present construction-related demands.

Other considerations would be the same as those for the proposed Cypress Ridge site.

4.12.3.3 Boathouse Flats

Cumulative impacts of the proposed project at Boathouse Flats would be the same as for the proposed Cypress Ridge site.

4.12.3.4 Vina Terrace

Cumulative impacts of the proposed project at Vina Terrace would be the same as for the proposed Cypress Ridge site.

4.12.4 MITIGATION MEASURES

4.12.4.1 Cypress Ridge

No mitigation measures are anticipated for the proposed action at the Cypress Ridge site.

4.12.4.2 SLC-6

No mitigation measures are anticipated for the proposed action at the SLC-6 site.

4.12.4.3 Boathouse Flats

No mitigation measures are anticipated for the proposed action at the Boathouse Flats alternative site.

4.12.4.4 Vina Terrace

No mitigation measures are anticipated for the proposed action at the Vina Terrace alternative site.

4.13 LAND USE IMPACTS AND RELATIONSHIP TO PLANS

Criteria for evaluating potential land use impacts are based on compatibility of proposed activities with surrounding land uses and on conformance with applicable ordinances and permit requirements.

An impact would be considered significant if one or more of the following would occur as a result of the proposed action:

- Conflict with applicable ordinances and/or permit requirements.
- Non-conformance with approved land use plan(s).
- Preclude adjacent or nearby properties being used for existing activities.
- Conflict with adopted environmental plans or goals of local community.
- Conflict with established uses of the area.
- Conversion of prime agricultural land to other use or impairment of productivity of prime agricultural land.

4.13.1 REGIONAL IMPACTS

4.13.1.1 Regional Land Use

Operation of the proposed project would result in a slight increase in the number of times offsite land use activities are disrupted by launch events at VAFB. Launch events at VAFB are expected to increase a maximum of three per year with the activation of the proposed facility (see Table 4.13.1, Projected Missile Launch Rates, VAFB 1986-1995). Uses that may be disrupted include offshore oil and gas extraction. Commercial activities such as fishing in the inner Santa Barbara Channel also could be affected. Such impacts are short-term events, lasting until the potential hazards associated with launch activities have passed.

These impacts would be disruptive should it become necessary to exclude a relatively large number of persons from an area due to a potential safety risk primarily associated with a launch event. Public safety during space launch operations becomes an issue when the number of individuals and the population density or concentration reaches a level where the risk to the group increases to an unacceptable level. The potential for such risk is defined by USAF safety guidelines and procedures. The potential risk from a given space launch is a function of the vehicle, its launch location, and its launch azimuth.

TABLE 4.13.1

PROJECTED MISSILE LAUNCH RATES
VAFB 1986 - 1995

VEHICLE	LAUNCHES PER YEAR[5]									
	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
Atlas[1]	2	1								
Scout[2]	1	1	1	1	1	1	1	1	1	1
Thor/Delta[1]	0	0	0							
Titan III B[1]	0	1								
Titan 34 D[1]	1	1	1							
Titan II[3]			1	3	3	3	3	3	3	3
Titan IV[3] (SLC-4E)				1	2	2	2	2	2	2
Titan IV[4] (SLC-7)										3
TOTAL	4	4	3	5	6	6	6	6	6	9

(1) Program being phased out (US DOT 1988).
(2) Government maximum launches per year (US DOT 1988).
(3) Projected launches (USAF 1988b).
(4) Projected launches (see Section 2.1.6).
(5) Years 1986 and 1987 reflect actual launches.
Years 1988 through 1995 represent predicted launches.

4.13.1.2 Regional Land Use Plans

If the Bixby Ranch were developed for residential use as permitted by current zoning, structures and persons would be within the launch range hazard zone for operations at either the proposed or alternative sites, as well as other, currently active space launch complexes at South VAFB.

In its recently updated Safety and Hazard Risk Assessment, the USAF concluded that development at Bixby Ranch or other privately owned properties east of VAFB would be incompatible with the future of space operations and safety at VAFB. As a result, the USAF has begun a detailed study of the real estate interests involved in order to define a potential land acquisition, both of the Bixby Ranch property and other affected private lands near VAFB. The purpose of such a program would be to protect the USAF polar orbit capability for as long as it is needed. The USAF will continue to oppose any incompatible development through the local planning and zoning process (USAF 1988j).

4.13.2 LOCAL IMPACTS

4.13.2.1 VAFB Land Use

Cypress Ridge

The proposed action would alter about 120 acres of undeveloped land in South VAFB to "Airfield Operation and Maintenance" use, the USAF classification for space and missile launch facilities. This amount of land is less than 0.01 percent of South VAFB's approximately 35,000 acres of grazing land and would not be significant. Implementation of the SLC-7 at this site would be consistent with existing space launch facilities and operations and would maintain the trend, first established in 1959, of using South VAFB for space launch activities.

Use of the proposed Cypress Ridge site for launches would result in temporary disruption of existing offsite land uses that are within the Range Safety Zone. In order to manage the increased risk due to concentrations of population at Jalama Beach County Park, the USAF has negotiated an agreement with park officials to close the park when USAF safety models indicate that those in the park would be exposed to an unacceptable risk from a VAFB launch. Offshore oil platform operators in the outer continental shelf would also be encouraged to remove personnel during launch operations, as recommended by USAF regulations.

The existing Space Shuttle External Tank landing facility at the Point Arguello former U.S. Coast Guard Rescue Station would be used to unload Mobile Service Tower (MST) subassemblies from shallow draft barges during project construction. This facility was constructed under the Space Shuttle program, and its use was determined to be consistent with Coastal Zone regulations. Use of the facility during construction would require removing silt that has accumulated around the landing area since its original construction. This silt removal would be considered facility maintenance permitted by the Space Shuttle EIS. No new dredging would be performed. The removal of the accumulated silt would not create additional impacts to those addressed for the Space Shuttle program.

SLC-6

Implementation of the SLC-6 alternative would utilize developed land on South VAFB, which has been classified as "Airfield Operation and Maintenance" use. Use of this site would not affect existing land use or land classification. In addition, utilization of the SLC-6 alternative would avoid the land use impacts that would occur if one of the undeveloped sites were chosen.

The impact of the SLC-6 alternative to other on-base and off-base land uses would be the same as described for the proposed Cypress Ridge site.

Boathouse Flats

The Boathouse Flats alternative would alter about 130 acres of undeveloped land on South VAFB to "Airfield Operation and Maintenance" use. This amount of land is less than 0.5 percent of South VAFB's approximately 35,000 acres of grazing land and would not be significant.

The impact of the Boathouse Flats alternative to other on-base and off-base land uses would be the same as described for the Cypress Ridge site.

Vina Terrace

The Vina Terrace alternative would alter about 150 acres of undeveloped land on South VAFB to "Airfield Operation and Maintenance" use. This amount of land is less than 0.5 percent of South VAFB's approximately 35,000 acres of grazing land and would not be significant.

The impact of the Vina Terrace alternative to other on-base and off-base land uses would be the same as described for the Cypress Ridge site.

4.13.2.2 VAFB Comprehensive Plan

Cypress Ridge

SLC-7 is listed as a short-range need in the draft Comprehensive Plan for Space and Missile Operations at VAFB. Implementation of the proposed action at the Cypress Ridge site would fulfill this need. The project would be consistent with Mission Accomplishment and Flexibility and Expansion objectives by enhancing VAFB's primary mission of space and missile launching. Construction of the SLC-7 facility would continue the need for USAF encroachment management responsibilities for range safety, a long-term need addressed in the draft Comprehensive Plan (USAF 1988b).

SLC-6

The relationship of the SLC-6 alternative to the draft Comprehensive Plan for VAFB is the same as that described for the proposed Cypress Ridge site.

Boathouse Flats

The relationship of the Boathouse Flats alternative to the draft Comprehensive Plan for VAFB is the same as that described for the proposed Cypress Ridge site.

Vina Terrace

The relationship of the Vina Terrace alternative to the draft Comprehensive Plan for VAFB is the same as that described for the proposed Cypress Ridge site.

4.13.2.3 Coastal Zone Management

A separate Coastal Consistency Determination has been prepared, describing activities affecting the Coastal Zone and their impacts. This document has been submitted to the California Coastal Commission for review and comment. The proposed action is in compliance with the Federal

Coastal Zone Management Act of 1972, which states that all activities taking place within the Coastal Zone will comply to the "maximum extent practical" with state regulations, thereby reducing the possibility of significant impacts.

4.13.3 CUMULATIVE IMPACTS

The activation of the Titan II and Titan IV programs at SLC-4 West and SLC-4 East, respectively, and the proposed Titan IV/Centaur program, are anticipated to increase launches from South VAFB from the present number of four to nine per year. The additional three launches created by the activation of the proposed project would lead to additional disruptions to activities occurring within the range safety area. These would include impacts to use of the Boathouse area at South VAFB. Since these interruptions would be short-term, their associated impacts also would be short-term. An additional three launch events per year would not result in significant cumulative impacts to existing land uses.

The additional launches could impact potential use of the Bixby Ranch properties. The federal government lacks the authority to regulate land use on non-federal lands to prevent encroachment of incompatible uses into launch Range Safety Zones, such as would occur with development of the Bixby Ranch. Therefore, under independent action, the USAF is engaged in preliminary activities to acquire lands which, under other ownership, could adversely affect the USAF mission at VAFB.

4.13.4 MITIGATION MEASURES

4.13.4.1 Cypress Ridge

Impacts to land use from implementation of the proposed project at Cypress Ridge would be short-term and infrequent. Therefore, no mitigation measures are required.

4.13.4.2 SLC-6

No mitigation measures would be required for the proposed action at the SLC-6 alternative site for the same reasons mentioned for the Cypress Ridge site.

4.13.4.3 Boathouse Flats

No mitigation measures would be required for the proposed action at the Boathouse Flats alternative site for the same reasons mentioned for the Cypress Ridge site.

4.13.4.4 Vina Terrace

No mitigation measures would be required for the proposed action at the Vina Terrace alternative site for the same reasons mentioned for the Cypress Ridge site.

4.14 RECREATION

Project-related activities that could affect recreation would occur primarily during space vehicle launches. Impacts would result from closure of USAF and public use areas for reasons of safety.

Impacts to recreation would be considered significant if one or more of the following were to occur as a result of implementation of the proposed action:

- Conflict with established recreational use of the area.
- Alter recreational desirability of the area.
- Create need for new recreational facilities/areas.

4.14.1 REGIONAL IMPACTS

The preliminary construction schedule for the proposed action and Titan IV/Centaur processing time line indicate that initial project launch capability would be achieved in late 1994. Periodic, short-term impacts from closures of Jalama Beach County Park are expected. A maximum of three Titan IV/Centaur launches per year are planned. Since the space vehicle overflights would have a southern trajectory, it is anticipated that Jalama Beach County Park would be closed during these launches. No significant long-term impact to public recreation opportunities is anticipated.

4.14.2 LOCAL IMPACTS

Access to the South VAFB shoreline from Jalama Beach would be affected by the proposed action, as the area would be evacuated prior to launch. Also, use of the Boathouse area would not be permitted during launch events. It is planned that there would be a maximum of three launch events per year. The effect on local recreational opportunities would not be significant.

4.14.3 CUMULATIVE IMPACTS

Current closures of county parks are related to projected space vehicle launches from South VAFB. Currently, these are comprised of Atlas (two to three per year), Titan II (one to two per year), and Titan IV (two to three per year). The Air Force plans to discontinue the Atlas program prior to the SLC-7 initial launch capability. This would result in an overall decrease of two to three launches per year.

Predicted launches are shown in Table 4.13.1 for the years 1988 through 1995. Activation of the proposed project in 1994 would result in an increase of three launches per year. A cumulative total of nine launches could result in Jalama Beach County Park closures in 1994. No significant impact to public recreation opportunities is expected to result from these closures.

4.14.4 MITIGATION MEASURES

4.14.4.1 Cypress Ridge

Because no significant impacts to recreation in the area have been identified due to the short term effects of a launch from Cypress Ridge, no mitigation is required.

4.14.4.2 SLC-6

Because no significant impacts to recreation in the area have been identified due to the short term effects of a launch from SLC-6, no mitigation is required.

4.14.4.3 Boathouse Flats

Because no significant impacts to recreation in the area have been identified due to the short term effects of a launch from Boathouse Flats, no mitigation is required.

4.14.4.4 Vina Terrace

Because no significant impacts to recreation in the area have been identified due to the short term effects of a launch from Vina Terrace, no mitigation is required.

4.15 RELATIONSHIP BETWEEN LOCAL SHORT-TERM USE OF THE ENVIRONMENT AND THE MAINTENANCE AND ENHANCEMENT OF LONG-TERM PRODUCTIVITY

4.15.1 USAF USE AND PRODUCTIVITY

Implementation of the proposed action at one of the three undeveloped sites would involve the use of approximately 120 to 150 acres of land on South VAFB and fencing of approximately 50 acres to accommodate the spatial needs of the project. Implementation of the proposed action at the SLC-6 site would maximize the use of this currently underutilized facility and enhance short-term productivity. Implementation would commit the proposed or alternative site to "Airfield Operation and Maintenance" use for the minimum design period of 25 years, thereby precluding alternative uses in the short-term. Implementation of the proposed action at SLC-6 would, however, preclude utilization of this location to support other, future launch programs, such as the Space Shuttle. The proposed action also would utilize existing facilities on VAFB for certain processing functions. Therefore, the proposed action represents an effort on the part of the USAF to maintain and enhance the long-term productivity of VAFB by utilizing existing land and facilities for new projects.

Current USAF plans involve the use of expendable launch vehicles for delivery of satellites into near-polar orbits. The proposed action would assist in implementing such plans.

In the preceding sections of this document, it has been demonstrated that the short-term effects resulting from construction of ground support facilities and systems can be mitigated to a level of insignificance and that there are few significant long-term effects.

Pursuant to the actions of construction would be the use of the environment as necessary to carry out ground operations and attendant launches. In general, short-term effects would be minor and non-persistent. Primary exceptions would be short-term changes in ambient noise and air quality conditions resulting from Titan IV/Centaur engine activation, launch, and/or ascent maneuvering and potential subsequent effects to terrestrial and marine wildlife. There also is the potential for short-term events such as spills, fires, or explosions which, if not contained, could have significant impacts. These are of concern relative to human health and safety, as well as to their potential for longer term effects to special interest flora and fauna.

There would be a long-term (over the life of the project) effect to the Lompoc Terrace (local) aquifer which supplies water to South VAFB. Water requirements for the operation phase of the proposed action are expected to increase demand on the aquifer by a maximum of about 17 percent. This would result in minor overdraft (45 acre-feet/year) and potentially reduce the amount of water available from this aquifer for other purposes, such as additional space launch complexes. Other long-term effects are considered compatible with current USAF plans to maximize the usefulness of VAFB and its facilities.

4.15.2 COMMUNITY USE AND PRODUCTIVITY

Effects of short-term use of community resources to support the proposed project would be minimal compared to the potential benefits of long-term productivity. The proposed project would facilitate the maintenance of current employment and economic support levels in nearby communities, primarily Lompoc and Santa Maria and, to a lesser extent, other Santa Barbara County and contiguous areas.

Project construction would utilize local personnel, as available, or would import workers for the relatively short-term construction period, thereby either maintaining or enhancing local employment. Project operations would result in the permanent influx of about 400 civilian and military personnel, thereby enhancing the long-term economic growth and productivity of communities within commuting distance of VAFB. Such growth could create a need for additional housing and result in the alteration of some areas from agricultural to residential uses. With appropriate planning, such alteration could increase overall productivity, while at the same time maintaining the area's primarily rural character.

Concurrent with expected community growth would be an increased demand for water resulting from the anticipated influx of population associated with project construction and operations. The maximum project-related demand is anticipated to increase regional demand for water by approximately 0.2 percent. This would occur in areas where water supply is currently in overdraft condition. Such effect is considered to be significant, utilizing the water for short-term needs, potentially at the expense of potentially restricting long-term community growth, such as is currently occurring in the South County area.

4.16 IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES FROM IMPLEMENTATION OF THE PROPOSED ACTION

4.16.1 MATERIAL RESOURCES

The major commitment of resources during construction and operations would involve the use of energy and materials. Materials utilized for the construction of launch complex facilities and space vehicle components include wood, cement, aggregate, plastics, steel, aluminum, and other metals. Construction of the proposed project at SLC-6 would result in the commitment of substantially less material than would be needed for construction at the proposed Cypress Ridge site. This demand for less material is due to the existence of major, usable structures at the SLC-6 site.

The major commitments of materials during operations would include aluminum, steel, titanium, and other metals. Also utilized would be certain exotic, unique, or particularly valuable materials such as gold, platinum, and special ceramics and cements. These would be expended and lost during the fabrication of special application components of the space launch vehicle or expended during launch operations.

Most of the materials that would be expended are not in short supply. Construction materials such as wood, cement, asphalt, aggregate, paint, fuel, and structural steel are readily available from suppliers in the region. Their use for the proposed action would not limit other, unrelated regional construction activities, such as the development of offshore oil and gas reserves. Fuels utilized for testing and launch would be irretrievably lost. Solid and liquid rocket propellants are manufactured from abundant chemicals.

4.16.2 ENERGY RESOURCES

For all practical purposes, the commitments of resources discussed below are irreversible and irretrievable and, for purposes of this analysis, are presumed to be permanent, with subsequent long-term effects.

Energy resources utilized for construction and operations would be irretrievably lost. These include petroleum based products such as diesel fuel and gasoline, plus electric energy and propane. During construction, diesel fuel would be used for the operation of heavy equipment and

machinery. During operations, its primary use would be for the emergency power generator, with onsite fuel storage. Gasoline would be utilized for personnel vehicles during both the construction and operations phases of the project.

Project operations would generate an ongoing demand of about 8,000 kVA for electricity from local utilities. In addition, vehicle launch power would be generated by the STS Power Plant, supplied via a new 12.47 kV power line.

4.16.3 LAND

Implementation of the proposed action at one of the three undeveloped sites would result in approximately 120 to 150 acres of land being occupied by SLC-7 facilities. This land would be lost to other uses over the life of the proposed action. The area could be returned to existing open space uses if buildings, roads, launch facilities, and other structures were removed and the land revegetated at the end of the useful project life. Alternatively, the facilities could be modified for use in other programs subsequent to SLC-7 program termination. Implementation of the proposed action at SLC-6 would not cause any changes in the commitment of land resources since the site is actually developed for space launch purposes.

4.16.4 WATER

Water utilized due to the proposed action would not be available for other uses. This includes water demands at the project site, as well as water utilized offsite by construction and operations personnel and their families.

Water utilized for the proposed action would be supplied from the South VAFB water supply system. During construction, uses primarily would be for dust control. Operational water requirements would be primarily for daily domestic use and launches, estimated to be 45 acre-feet per year. Offsite domestic uses would be supplied by community water sources, primarily in Lompoc and Santa Maria. This demand is anticipated to slightly increase the existing overdraft of regional ground water basins.

4.16.5 VEGETATION AND WILDLIFE

Project implementation at one of the three undeveloped sites would result in approximately 120 to 150 acres of vegetation/habitat being supplanted by project facilities. This amount is less than

one percent of the land area and a small portion of the available and comparable habitat on South VAFB. About 65 acres of land associated with the communications and utility corridors would be temporarily disrupted during the construction period and then revegetated. Implementation of the proposed action at SLC-6 would not cause any change in the long-term commitment of vegetation and wildlife since the site is already developed for space launch purposes.

Some growth of local communities, resulting in conversion of agricultural land to urban uses and subsequent loss of vegetation and wildlife habitat, could result from implementation of the proposed action. It is anticipated that the extent of such change related to the proposed action would be minimal, but considered irreversible. Also, assuming the worst-case (greatest) growth analysis previously addressed, the expected growth attributable to the proposed action would be a small fraction of the growth anticipated to occur in the area, even without the proposed project.

4.16.6 HUMAN RESOURCES

The use of human resources for construction and operation is considered an irretrievable loss only in the sense that it would preclude such personnel from engaging in other work activities. However, depending on the status of other projects in the area, primarily offshore oil and gas activities during the proposed period of project construction, these personnel resources may be underutilized within the Santa Barbara County area.

4.16.7 VISUAL RESOURCES

Implementation of the proposed action at one of the three undeveloped sites would result in the irretrievable loss of an uninterrupted view to the north from Jalama Beach. This would occur over the life of the proposed action, as well as during potential subsequent space launch activities, and would be created by the large vertical elements of the space launch complex: (1) the mobile services tower, (2) the umbilical tower, and (3) the space launch vehicle itself. Implementation of the proposed action at one of the undeveloped sites also would irretrievably affect the view of South VAFB from offshore, effectively extending the line of launch facilities an additional mile to the south. These effects could largely be offset by removing the tall structures at the end of the useful life of the facility.

Implementation of the proposed action at SLC-6 would not irretrievably change the visual resource quality of Jalama Beach since SLC-6 cannot be seen from that perspective. Implementation of the proposed action at SLC-6 would not irretrievably alter the view of South VAFB from offshore since the majority of the necessary facilities already exist, and potential modifications would be relatively minor.

4.17 UNAVOIDABLE ADVERSE EFFECTS

In general, most known effects resulting from implementation of the proposed project at either SLC-6 or one of the undeveloped sites would be mitigated to a level of insignificance through project planning and design measures and by utilization of prescribed USAF operational procedures. Because of this, most potential adverse effects would be avoided, and those that could not be avoided would not be significant. Therefore, few significant unavoidable adverse effects would be associated with the proposed action. Section 4.17.1 addresses those that are expected to occur or have the potential to occur. Section 4.17.2 discusses other anticipated or potential unavoidable adverse effects. Section 4.17.3 discusses considerations that offset adverse environmental effects.

4.17.1 SIGNIFICANT UNAVOIDABLE ADVERSE EFFECTS

4.17.1.1 Geology and Soils

The impacts from a major regional earthquake would be unavoidable and, depending on the magnitude, potentially significant and adverse. Erosional soil loss during project construction at one of the undeveloped sites is expected to be locally significant, depending partially on the extent of inclement weather that would occur during the period of rough grading. Implementation of the proposed project at SLC-6 would cause minimal additional soil loss since earth moving activities and excavation are not anticipated. Other soil loss would be minimal, as site restoration and reclamation would be implemented at appropriate stages of project construction and over the long-term life of the proposed facility.

4.17.1.2 Water Use

The water requirements for project operations would be about 45 acre-feet per year from the Lompoc Terrace aquifer. Currently, the recharge and withdrawal rates are about even, so the proposed action would be expected to result in a drawdown equivalent to project requirements. Although the actual amount of the drawdown is slight, the existence of an overdraft condition is considered to be significant in the long term. To the extent possible, this water would be recycled. On a regional level, increased domestic use resulting from an influx of population could result in the requirement for an additional 305 acre-feet per year from a regional water supply that currently is in overdraft. This use is less than 0.1 percent of existing use but, because of the overdraft condition, is considered to be significant.

4.17.1.3 Vegetation

Project construction at the Cypress Ridge site is expected to result in a locally significant impact to the Federal Category 2 candidate species *Monardella undulata* var. *frutescens*, since approximately 800 to 1,000 specimens at the southern limit of the species' range would be lost due to project activities. Such effect, however, would not be significant on a regional scale. Construction of the proposed action at SLC-6 would not significantly impact this species since no additional earth moving or excavation is anticipated. There also is the potential for a significant adverse impact to vegetation from the occurrence of a catastrophic event at either the proposed or one of the alternative sites.

4.17.1.4 Health and Safety

There is the potential for significant impacts due to the types of materials (flammable/explosive/ toxic) to be utilized and, therefore, subject to transport and handling incidents. The potential for mishap would be controlled to the maximum extent possible by USAF rules, regulations, and procedures. However, there is still the potential for container malfunction or human error, which could result in the release of materials to the atmosphere and consequent significant adverse impacts.

4.17.2 OTHER UNAVOIDABLE ADVERSE EFFECTS

4.17.2.1 Vegetation

Vehicle launch procedures would result in the presence of an exhaust cloud and consequent acidic deposition, anticipated to be within an area of about three miles from the launch site. The potential impacts could involve damage to sensitive species, a change in vegetative cover type, and/or loss of special interest plants. Based on results of other space vehicle launches, such impacts are not expected to be significant.

4.17.2.2 Wildlife

The noise and sonic boom resulting from a launch event would be expected to adversely affect marine birds, pinnipeds, and terrestrial wildlife. The Western gull colonies on San Miguel Island are expected to experience minor egg losses, but these would not be significant. Pinnipeds may

exhibit startle responses, but subsequent mother-pup separations are not anticipated. Terrestrial biota within a three- to five-mile radius of the launch site may experience physiological damage such as short-term hearing loss. The same effect may occur to sensitive mammals within a two- to three-mile radius. None of these potential unavoidable impacts is expected to be significant.

The potential for impacts from launch-related emissions would be short-term. Sensitive species known to be in the area, including the peregrine falcon, brown pelican, and California least tern, are transient and migrant and would be subject to effects that are localized, short-term and, therefore, not significant.

4.17.2.3 Waste Management

Implementation of the proposed action would result in the generation of certain hazardous wastes. These would be treated and disposed of in accordance with state and federal regulations and so would not be significant. However, the generation of the hazardous waste is unavoidable. It is considered to be adverse because of the potential hazards to the environment in the event of improper handling and because its correct treatment would effectively shorten the useful life of disposal facilities.

4.17.2.4 Cultural Resources

Implementation of the proposed action at one of the three undeveloped sites would impact archaeological resources within the launch complex area and utilities corridors as a result of earth moving and other construction activities. To the extent possible, such impacts would be mitigated through avoidance or data recovery and, therefore, would not be significant. Implementation of the proposed action at SLC-6 would not impact archaeological resources since no earth moving or excavation is anticipated.

Caliche plant fossils on San Miguel Island would be adversely affected by launch-related sonic booms. This would accelerate the inevitable and ongoing process of the fossils breaking in response to removal of the surrounding sand. Such impacts would not be significant, as this process would occur with or without implementation of the proposed action.

4.17.2.5 Transportation

There would be unavoidable increases in traffic as a result of project construction and operations. Implementation of the proposed action at SLC-6 would result in substantially less construction traffic than would development of one of the other three sites. Operations-related traffic increases would be the same for the four potential sites. These increases could result in delays at the Main and South Gates of VAFB, especially during peak traffic times. This impact could be mitigated to some extent through carpooling and personnel scheduling and would not be significant.

4.17.2.6 Land Use and Recreation

Certain land uses would be disrupted as a result of proposed project operations. During launch events, the USAF clears the offshore area of commercial and recreation vessels and recommends that non-essential personnel be removed from offshore oil and gas platforms. Recreationists would also be kept from nearby Jalama Beach and other shoreline areas, plus the VAFB Boathouse picnic area. These interruptions would be short-term, infrequent and, therefore, not significant.

4.17.3 CONSIDERATIONS THAT OFFSET THE ADVERSE ENVIRONMENTAL EFFECTS

The potential benefits of the proposed project at VAFB are local, regional, and national in scope. At the local level, communities in the vicinity of VAFB would experience economic stimulation from increases in employment opportunities, demands for goods and services, and the tax base. Employment and population growth are expressed goals of the Lompoc area, and the proposed project would induce such growth. Further, implementation of the proposed action would offset the potential adverse consequences to local economies of a gradually declining work force at VAFB. Without the project, direct and indirect employment from operations at Vandenberg would be expected to remain constant or possibly decline unless expanded or additional programs replace those currently in effect. Economic benefits and increased employment also would benefit the larger regional area. Although such effects would not be as evident as local benefits, they would constitute considerations that offset potential adverse impacts.

National and international benefits of the proposed project include improved national defense and observational capabilities, with the ability to launch satellites into near-polar orbit. Such orbit provides perpendicular coverage of the planet, thereby enhancing defense, weather, and earth resources surveillance.

Further, implementation of the proposed project at VAFB is critical to the satisfaction of overall program goals. Because the types of missions that can be flown from VAFB are different and complementary to those planned for operations at Cape Canaveral, operations from both facilities are required. National and international benefits to be derived from the program would result from the proposed activities at VAFB.

Chapter 5.0

LIST OF PREPARERS

5.0 LIST OF PREPARERS

This Draft Environmental Impact Statement has been prepared by Environmental Solutions, Inc. for the Department of the Air Force, Space Division. Environmental Project Manager Robert Mason of the Air Force Environmental Planning Division (SD/DEV) also provided information and assistance in preparing this draft report.

U.S. Air Force, Space Division

ROBERT MASON
Chief, Environmental Planning Division
M.A. Urban and Regional Planning, 1978, University of Southern California
B.A. Urban and Regional Planning, 1975, California State University, Northridge
Member, American Institute of Certified Planners, 1988

Ten years experience as project manager for various projects including:

- Environmental Assessments and Environmental Impact Statements.
- Air Pollution Control.
- Hazardous Waste Treatment.
- Permits for projects which include the U.S. Air Force Space Shuttle, radar stations, and missile programs.

JOHN R. EDWARDS
Environmental Project Manager
M.S. Environmental Engineering, 1976, University of Southern California
B.S. Zoology, 1973, University of California, Los Angeles

Eleven years experience as an environmental engineer and project manager for various projects including:

- Environmental Assessments and Environmental Impact Statements.
- Air Pollution Control.
- Hazardous Waste Treatment.
- Permits for projects which include the U.S. Air Force Space Shuttle, radar stations, and missile programs.

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MIRO KNEZEVIC
Executive Vice President
Principal Resource Coordinator
Ph.D. Civil Engineering, 1978, University of Southern California
M.S. Civil Engineering (Environmental), 1973, University of Maryland
B.S. Civil Engineering, 1971, University of Maryland

Ten years of experience as project engineer and project manager for various projects including:

- Environmental Assessments.
- RCRA Part B compliance documentation.
- Surface and ground water quality assessments.
- Waste Discharge Requirement Reports for the STS Power Plant and Space Shuttle Launch Pad, Vandenberg Air Force Base (VAFB).
- Management and engineering activities associated with MX and Assembly Test and System Support construction surveillance at VAFB, hazardous waste inventory and assessment for RCRA Part A at VAFB, RCRA Part B preparation for Kirkland Air Force Base, and RCRA Part B compliance evaluation for radioactive waste for the Waste Isolation Pilot Plant for the DOE.

TIM C. LASSEN
Project Manager
B.S. Civil Engineering, 1970, Purdue University
P.E. State of California, 1983

Eleven years of experience in environmental management and engineering activities including:

- Environmental Assessments and Permitting.
- Project Director on landfill project for major rail transportation company.
- Project Manager on hydrogeological assessments, remedial action plan development, and cleanup of contaminated soil and ground water.
- Manager, Environment and Hazardous Materials Control for major rail transportation company. Responsible for the following programs: Principal reviewer of Environmental Assessments (EA) and Environmental Impact Reports (EIR), environmental audits, spill response and prevention, hazardous waste management, industrial wastewater treatment, state and CERCLA Superfund, underground tank inventories and compliance, air quality, asbestos, and noise abatement programs.

DANIEL M. EVANS
Project Manager
M.S. Planning, 1985, University of Tennessee
B.A. Political Science, 1976, Knox College

Eleven years of experience in environmental impact analysis and project management including:

- Environmental Assessments and Environmental Impact Statements.
- Development and implementation of methodology to gather socioeconomic data used in microcomputer analytical system for Dam Safety Risk Analysis Regional Data Development for the U.S. Army Corps of Engineers.
- Participated in preparation of Environmental Analyses for small Hydropower Developments for the Federal Energy Regulatory Commission.
- Part of an interdisciplinary Oak Ridge National Laboratory team "Analyzing Water Resources Issues for the 1980s."
- Management of environmental impact analysis team for the final Environmental Assessment for the proposed Northeast Regional Communications Facility.
- Regional Economic/Environmental Policy Analysis for the Department of Energy, included environmental implications of regional industrial shifts, regional fuel consumption forecasting for the manufacturing sector, and analysis of product mix and energy intensity as determinants of energy consumption.

CAROLYN E. TRINDLE
Assistant Project Manager
M.A. Business Administration, 1981, Pepperdine University, California
M.A. Secondary Education, 1974, University of Missouri, Kansas City
Bachelor of Journalism, 1965, University of Missouri, Columbia

Twelve years of experience in project management and environmental planning for various projects including:

- Environmental Assessments and Environmental Impact Reports for major mining and energy development projects.
- Socioeconomic and planning documents for proposed industrial projects and military installations.
- Environmental documents for establishing the F/A-18A aircraft at Kaneohe Bay, Oahu, Hawaii, and for impacts of constructing satellite earth stations in urban Southern California locales.
- Permitting for major mining projects.

PETER HAYDEN
Assistant Project Manager
B.S. Mathematics, 1980, University of the Pacific, Stockton, California

Eight years of experience in air quality research including:

- Development of emissions inventories.
- Conducting and managing air quality studies to assess regulatory compliance of existing and proposed facilities.
- Conducting air quality monitoring and modeling studies to determine ambient pollution concentrations in the vicinity of industrial and government facilities.

DAVE BROWN
Project Planner
M.S. Geography, 1984, University of California, Riverside
B.S. Geography, 1980, University of California, Riverside

Project management activities include:

- Principal author of EIS/EIR for Bureau of Land Management gold mine project.
- Management of EIRs and EAs for commercial, industrial, and residential projects. Supported environmental documentation through public and agency reviews and public hearing processes.
- Conducted environmental technical analyses, including land use consistency and compatibility, aesthetics, socioeconomic, infrastructure requirements and availability, and fiscal impact.

GREGORY S. KINDT
Project Engineer
B.S. Chemical Engineering, 1985, South Dakota School of Mines and Technology

Participated in engineering activities in support of:

- Environmental Assessment (EA).
- Air quality, hazardous waste, and risk assessments.
- Regulatory and hazardous emissions reviews for gold mine.

NICHOLAS ABOUFADEL
Project Engineer
M.S. Civil Engineering, 1985, California State University, Long Beach
B.S. Civil Engineering, 1984, California State University, Long Beach

Engineering activities in private and public sectors include:

- Management of subsurface geotechnical explorations, data evaluation, and construction of multi-story building, roads, and airport.
- Authored soil investigation reports for buildings throughout Southern California.
- Design of pavement structure, sewage, utility, grading, and drainage plans.

JOHN ELLIS
Senior Process Engineer
B.S.C. Chemical Engineering, 1954, London University
Chartered Engineer U.K., M.I.Ch.E.

Over 30 years of chemical engineering experience including:

- State water and air quality permitting.
- Process design and economic evaluation.
- Contributing author of the Air Pollution Control Administration book on design of wet scrubbers.
- Design of by-product recovery and waste neutralization plants.
- Holds several patents in U. S. and U. K. on inorganic chemical processing.

MARSHALL PAYNE
Project Geologist
M.S. Engineering Geology, University of Arizona, Tucson
B.S. Geology, Arizona State University, Tempe

Over 22 years of engineering geology experience including:

- Principal hydrologist for site characterization and leachate wo..plan for Operating Industries, Inc. landfill, Monterey Park, California.
- Principal geologist on two major gold mine projects in California and Nevada, which involved review and environmental assessment of geohydrologic conditions in accordance with federal regulatory and Subchapter 15 requirements.
- Responsible for conducting geologic, ground water, and geophysical investigations for over 60 projects in the U. S.
- Extensive field experience with geologic feasibility and hazards. Ground water and fault/seismic analyses for existing and proposed concrete, rock, and earthfill dams.

LARRY BEIL
Planner/Geologist
B.A. Geology, 1987, University of California, Santa Cruz
B.S. Environmental Sciences/Land Use Planning, 1976, Slippery Rock State College, Pennsylvania

Over ten years of environmental planning experience including:

- Environmental Impact Statements.

- Primary reviewer of all environmental documentation for various oil interests exploring for oil on VAFB (1983-1986).

- Responsible for development and maintenance of Vandenberg Air Force Base Comprehensive Plan (1981 to 1986). Ensured that environmental quality standards were maintained in planning and execution of base missions. Monitored design and construction stages to ascertain compliance with the federal regulations protecting water quality, endangered species, and cultural resources.

DONALD SHAW
M.S. Engineering Mechanics, Case Western Reserve University
B.S. Mechanical Engineering, University of Cincinnati
Professional Engineer, State of Pennsylvania

Twenty years of experience in engineering includes:

- Risk assessment.

- Review of hydrogeologic aspects of hazardous waste landfill to establish probable contaminant plume and migration rate.

- ASME Section III stress analysis of the Cirene Nuclear Power Plant containment shell subject to tornado, missile, seismic, thermal transient, and wind loads.

Environmental Solutions, Inc., Consulting Scientists

JULIE BALDWIN
Associate Project Engineer
TRC Environmental Consultants, Inc.
Mission Viejo, California
B.S. Chemical Engineering, 1987, Michigan State University

- Development of emission inventories.

- Performed air quality modeling using U.S. EPA air quality dispersion models.

- Analysis of meteorological monitoring station data.

PAUL COLLINS
Wildlife Consultant
M.A. Zoology, 1982, University of California, Santa Barbara
B.A. Zoology, 1973, University of California, Santa Barbara

- Wildlife consultant on six major EIS/EIRs for offshore oil developments in Santa Barbara County.
- Associate Curator of Vertebrate Zoology, Santa Barbara Museum of Natural History.

ROBERT GIBSON
Archaeologist
M.A. Anthropology, 1983, California State University, Hayward
B.A. Anthropology, 1972, University of California, Los Angeles

Fifteen years of experience as an archaeological consultant for government agencies and private companies on projects including:

- Environmental impact studies.
- Dating, description, and analysis of ethnohistoric data.
- Field director for archaeological surface and subsurface investigations, research, and mitigation on South VAFB.

JERRY HABER
Sonic Boom Analyst
NTS Engineering
Long Beach, California

Twenty years of experience in research and application of methods to assess the risks to complex systems generated by internal malfunctions and external events. Present emphasis is in the fields of seismic risk and airborne shock wave.

- Developer of computer program used at VAFB to predict ground level sonic boom levels from launch vehicles and aircraft.
- Directed activities to characterize STS and Titan ascent sonic boom effects, focusing, and window breakage.
- Consulted for USAF Noise and Sonic Boom Impact Technology program to upgrade computer codes for assessing ground level sonic boom.

ERIC HANSEN
Senior Consulting Scientist
TRC Environmental Consultants, Inc.
Mountlake Terrace, Washington
M.S. Civil Engineering, University of Washington
B.A. Physical Oceanography, University of Washington

Thirteen years of air quality consulting experience includes:

- Air quality and meteorological monitoring system installation.
- Evaluation of emissions from proposed new and renovated sources.
- Use of U.S. EPA dispersion models to calculate pollutant concentrations based on measured or assumed meteorological conditions.
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- Survey of VAFB vegetation communities for Basewide Biological Monitoring Program.

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- Principal investigator for cultural resources on several EIR/EISs.
- Author of numerous articles on North American Indians, including the Chumash who once populated the areas now occupied by South VAFB.

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9.0 LIST OF ABBREVIATIONS

1STRAD	First Strategic Aerospace Division
ACHP	Advisory Council on Historic Preservation (Federal)
AFB	Air Force Base
AFM	Air Force Manual
AFR	Air Force Regulations
AFS	Air Force Station
AFSC	Air Force Systems Command
Al_2O_3	Aluminum Oxide
ANSI	American National Standards Institute
AOU	American Ornithologists Union
AQAP	Air Quality Attainment Plan
AQIA	Air Quality Impact Analysis
ATC	Authority to Construct
BACT	Best Available Control Technology
CAAQS	California Ambient Air Quality Standards
CAP	Collection Accumulation Point
CARB	California Air Resources Board
CCC	California Coastal Commission
CCR	California Code of Regulations
CDFG	California Department of Fish and Game
CDOHS	California Department of Health Services
CDWR	California Department of Water Resources
CEQ	Council on Environmental Quality
CEQA	California Environmental Quality Act
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CESA	California Endangered Species Act
CFR	Code of Federal Regulations
cfs	Cubic feet per second
CHP	California Highway Patrol
CNDDB	California Natural Diversity Data Base
CNEL	Community Noise Equivalent Level
CNPS	California Native Plant Society
CO	Carbon Monoxide

CRWQCB	California Regional Water Quality Control Board
CSBRMD	County of Santa Barbara Resource Management Department
CY	Cubic Yards
dB	Decibels
dBA	Decibels (A-Weighted Sound Level)
DOD	Department of Defense
DOE	Department of Energy
DOHS	Department of Health Services
EIAP	Environmental Impact Analysis Process
EIS	Environmental Impact Statement
EPA	Environmental Protection Agency
ESA	Endangered Species Act (Federal)
ESMC	Eastern Space and Missile Center
ETR	Eastern Test Range
F	Fahrenheit
FEIS	Final Environmental Impact Statement
FPA	Flight Plan Approval
FTSA	Flight Termination System Approval
FVIS	Fuel Vapor Incinerator System
FVSS	Fuel Vapor Scrubber System
GN_2	Nitrogen Gas
gpd	Gallons per day
gpm	Gallons per minute
HCl	Hydrogen Chloride
HSWA	Hazardous and Solid Waste Amendments
HWTP	Hazardous Wastewater Treatment Plant
Hz	Hertz
ICBM	Intercontinental Ballistic Missile
ICC	Ice Suppression System
ICU	Intersection Capacity Utilization
ILC	Initial Launch Capability
IRP	Installation Restoration Program
km	Kilometers
kV	Kilovolt
kVA	Kilovolt-ampere

LCC	Launch Control Center
LCC	Launch Check-out Center
LCP	Local Coastal Plan
LD	Launch Exhaust Ducts
L_{eq}	Equivalent Sound Level
LH_2	Liquid Hydrogen
LM	Launch Mount
L_{max}	Maximum Sound Level
LN	Liquid Nitrogen
LO_2	Liquid Oxygen
LOS	Level of Service
LSS	Launch Support Structure
M	Earthquake Magnitude
MCL	Maximum Contamination Levels
Mg/L	Milligrams per liter
mg/m^3	Milligrams per cubic meter
MMPA	Marine Mammal Protection Act
MOL	Manned Orbital Laboratory
mph	Miles per hour
Ms	Surface Wave Magnitude
MSGSA	Missile System Ground Safety Approval
MST	Mobile Service Tower
MVA	Megavolt-ampere
N_2O_4	Nitrogen Tetroxide
NAAQS	National Ambient Air Quality Standards
NASA	National Aeronautics and Space Administration
NCP	National Contingency Plan
NDIR	Non-Dispersive Infrared Spectroscopy
NEPA	National Environmental Policy Act
NFPA/NFC	National Fire Protection Association/National Fire Codes
NHPA	National Historic Preservation Act
NIPDWR	National Interim Primary Drinking Water Regulations
NMFS	National Marine Fisheries Service
NO_2	Nitrogen Dioxide
NOAA	National Oceanic and Atmospheric Administration
NO_x	Nitrous Oxide

NPDES	National Pollution Discharge Elimination System
NPPA	Native Plant Protection Act
NRHP	National Register of Historic Places
NSR	New Source Review
NUS	No Upper Stage
O_3	Ozone
OAL	Operations Approval Letter
OSC	On-Scene Coordinator
OSB	Operations Support Building
OSHA	Occupational Safety and Health Administration
PCBs	Polychlorinated Biphenyls
PCR	Payload Changeout Room
PGA	Peak Ground Acceleration
PG&E	Pacific Gas and Electric Company
PLF	Payload Fairing
PM_{10}	Particulate matter less than 10 microns aerodynamic diameter
POTW	Publicly-owned treatment works
POVs	Privately-owned vehicles
ppm	Parts per million
PPR	Payload Processing Room
PSD	Preventative Source Determination
psf	Pounds per square foot
psi	Pounds per square inch
PTO	Permit to Operate
QD	Quantity-Distance Criteria
RCRA	Resource Conservation and Recovery Act
REEDM	Rocket Exhaust Effluent Dispersion Model
ROC	Reactive Organic Compounds
RSV	Ready Storage Vessel
RWQCB	Regional Water Quality Control Board
SAB	Shuttle Assembly Building
SAC	Strategic Air Command
SAMTO	Space and Missile Test Organization
SARA	Superfund Amendment and Reauthorization Act
SBCAPCD	Santa Barbara County Air Pollution Control District
SBCCAPC	Santa Barbara County Cities Area Planning Council

SC	Sandy clay
SSD/DEV	Space Systems Division/Division of Environmental Planning
SENEL	Single Event Noise Exposure Level
SHPO	State Historic Preservation Officer
SLAMS	State and Local Air Monitoring Stations
SLC-4, -6, -7	Space Launch Complex 4, 6, 7
SLC-4E	Space Launch Complex 4 East
SLC-4W	Space Launch Complex 4 West
SM	Silty Sand
SO_2	Sulfur Dioxide
SO_x	Sulfur Oxide
SP	Poorly graded sand with gravel
SPA	Statement of Program Acceptance
SPL	Sound Pressure Level
SPR	Spill Prevention and Response
SRMUs	Solid Rocket Motor Upgrades
STRAD	Strategic Aerospace Division
STS	Space Transportation System
SV	Satellite Vehicle
THC	Toxic Hazard Corridor
TNT	Trinitrotoluene
TOG	Total Organic Gases
TPCA	Toxic Pits Control Act
TSP	Total Suspended Particulates
UCSB	University of California, Santa Barbara
UDMH	Unsymmetrical dimethyl hydrazine
US EPA	United States Environmental Protection Agency
USAF	United States Air Force
USC	University of Southern California
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
UT	Umbilical Tower
VAB/HTF	Vehicle Assembly Building/Horizontal Test Facility
VAFB	Vandenberg Air Force Base
WINDS	Weather Information Network and Display System

WSMC	Western Space and Missile Center
WTR	Western Test Range
µg/L	Micrograms per liter
µg/m^3	Micrograms per cubic meter